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ABSTRACT

This instructor's lesson plan guide on the cardiovascular system is one of fifteen modules designed for use in the training of emergency medical technicians (paramedics). Seven units of study are presented: (1) the anatomy and physiology of the cardiovascular system; (2) patient assessment for the cardiac patient; (3) pathophysiology; (4) reading and understanding a normal electrocardiogram; (5) arrhythmia recognition; (6) treatment of the arrhythmia, specifically with cardiac drugs, and such skills as cardiopulmonary resuscitation, defibrillation and cardioversion, and rotating tourniquets; and (7) clinical experience in the emergency department and the intensive care unit/coronary care unit. Each unit contains these elements: behavioral objectives, teaching procedures, a content outline, demonstration outline, list of needed equipment and materials, and guidelines for activities to be performed by students applying the skills. Skill evaluation sheets are provided. It is suggested that each module can be presented individually or combined with other modules to construct a course for a selected group of students. (CE 017 514 is a course guide for use in planning and implementing the total training program.) (JH)

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National Training Course
EMERGENCY MEDICAL TECHNICIAN
PARAMEDIC
INSTRUCTOR'S LESSON PLANS

Module – VI
Cardiovascular System

CE 017 520

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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U.S. Department of Transportation / National Highway Traffic Safety Administration

National Training Course

EMERGENCY MEDICAL TECHNICIAN PARAMEDIC

INSTRUCTOR'S LESSON PLANS

Module – VI

Cardiovascular System

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CE 017 520

HOW TO USE THE INSTRUCTOR LESSON PLANS

NOTES

The *Instructor Lesson Plans* are guides for teaching an advanced-level training program for emergency medical technicians. The *Plans* cannot be used by the instructor to develop the competency to conduct the program; the instructor should have this as a prerequisite to teaching the course.

The *Instructor Lesson Plans* are comprised of 15 modules, each containing the information and instructions needed to conduct a program on a particular subject. Each module can be used by itself or in concert with other modules.

Each module is subdivided into instructional units that deal with a particular segment of the module subject. Generally, the units contain the following components:

- *Performance Objectives.* These are classified as knowledge (K) objectives or skill (S) objectives. They are written in behavioral terms so they can be evaluated either through observation of student activities or through results obtained under specified conditions.
- *Unit Activities.* Reading assignments, reference materials and outside activities are presented for both the students and the instructor. If the activities are identical, only the instructor's activities are presented.
- *Equipment and Materials.* Educational equipment includes chalkboard, overhead projector, slide projector, and screen. Medical equipment and materials required are drawn from those listed in Appendix F of the *Course Guide*.

- *Content Outline.* This presents the topics to be covered during the presentation of the unit. Where appropriate, it is divided into single skills or concepts. This approach gives the instructor the flexibility to add or delete specific skills and information. The content outline also provides directions to the instructor indicating when the use of demonstrations or group discussions would be most appropriate.

  Because the units are designed to be taught by technically competent instructors, the content outlines are not specific; they only enumerate topics and subtopics. It is expected that the instructor's skill and knowledge will supplement the depth of the course content outline. The instructor is encouraged to prepare additional notes.

- *Demonstration Outlines.* These are designed to present procedural steps that are important in performing the particular skill or calculation. Steps that are critical or that may lead to common errors are emphasized. Where critical steps exist, these outlines suggest what should be demonstrated.
- *Practice Sessions.* These sessions serve as guides to activities to be performed by students applying the skills. They may be performed in the classroom or assigned as homework. During classroom practice sessions, the instructor will be available to observe and correct student performance and to answer any questions.
- *Skill Evaluations.* The skill evaluation sheets provide checkpoints for the instructor to use to insure that students are following appropriate procedures or sequences. Skill evaluation sheets also provide a convenient method for feedback to students having particular problems with a given skill, and for monitoring a student's progress in attaining skill objectives.

  The skill evaluation should occur only after the students have had an opportunity to practice the skill under the supervision of the instructor. The skill evaluation sheets can be distributed during, or before, the demonstration or practice session. Thus, they can be used as a job aid during practice. They should not be used, however, as a job aid while the student is being evaluated. The sheets are designed to provide a learning and evaluation tool

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and are not intended to mandate performance in the field in a set manner, irrespective of the patient's condition or situation.

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Satisfactory performance of a given skill is defined as the correct performance of all steps in the proper sequence. The instructor's judgment is required to define correct performance and sequence of steps in a skill. Skill evaluations may be repeated at intervals throughout the course to assess skill decay and the need for remedial practice. Some instructors may wish to test skills immediately after they have been learned and again at the conclusion of the course.

The alphanumeric coding system is used to identify the various modules and units. When you see, for example, in Module II, **3.6.1.K**, the **3** indicates the unit, the **6** indicates the main instructional topic, the **1** indicates the subsection of the major topic outlined in **3.6**, and the **K** indicates the teaching objective (in this case, knowledge).

To illustrate further, **3.6.1.K** would translate into:

3 = Unit number
6 = The main topic of the instructional section (The first two numbers—e.g., **3.6**—refer to a major heading in the unit content outline.)
1 = A subsection of the major topic outlined in **3.6** (This number relates to the number of objectives listed under skill or knowledge objectives and not to the content outline.)
K = Knowledge objective
S = Skill objective

The three-digit reference numbers (e.g., **3.6.1**) within each module refer to the topical section in that module only. For example, in Module II, any topical heading with **3.6** as the first two digits refers to the discussion of the components of patient assessment in Unit 3.

A visual presentation of Unit 3, by Module II, of the coding system is presented on the following pages.

SAMPLE PAGE

CODING SYSTEM EXAMPLES

NOTES

- Abdomen
- Extremities

3.6.1.K Given a situation describing a patient with a possible illness or injury who may or may not be able to communicate, the student should be able to describe the procedure for evaluating the patient described. Minimally, the student should include the appropriate primary assessment and specify the order of the four components of the secondary assessment and the areas of the assessment that would be emphasized.

the demonstration, auscultation of the lung, heart, and abdominal sounds.

3.6.1.S Given a student posing as a communicative patient, the student should be able to demonstrate the procedure for conducting a patient assessment when the patient is suspected of having the following:

SAMPLE PAGE

CODING SYSTEM EXAMPLES

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8. Practice Session 3

3.6. Four components of assessment (order)

A. If the patient can communicate, determine if he has a medical or trauma-related problem.
   1. If a medical problem, the general order should be:
      a. Evaluate the diagnostic and vital signs.
      b. Develop the patient's history.
      c. Examine for a medical problem.

Skill Evaluation 3.6.1.S: Assessment of a Communicative Patient With a Suspected Trauma-Related Problem

Place an "X" in the appropriate column to indicate steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform the skill.

Equipment

Student posing as a victim
Stethoscope

Clinical Training

To present this program, it will be necessary to have access to the clinical units listed below. If a unit is not available, adjustments should be made to insure that the activities proposed for that unit are included in others. Specific guidelines for the clinical units are included in the modules. The student's training should be supervised in each of the following clinical areas:

- Emergency department
- Intensive care unit/coronary care unit
- Operating/recovery room
- Intravenous (IV) team
- Pediatric unit
- Labor suite/delivery room/newborn nursery
- Psychiatric unit
- Morgue
- Mobile intensive care unit

Sample forms for maintaining student activity records are included in the *Instructor Lesson Plans*. The forms are designed so that the medical director can determine the number of times, and how successfully, a student has performed a skill. The medical director also will be able to determine how much time the student needed to become proficient in the skill. Further, the medical director will be able to evaluate student performance under a number of preceptors, because certain skills are repeated in various clinical units (e.g., initiating an IV is performed by the student with the IV team and in the emergency department and intensive care unit).

Although the clinical experience is listed with the module, it need not be presented each time, even if a number of modules are being presented.

Testing and Evaluating the Student

It is recommended that each student be evaluated on proficiency of skill and knowledge at the completion of each module. Skill evaluation sheets have been provided for each skill in each unit. These sheets can be used as guides for evaluating the student's skill proficiency. The evaluation of the knowledge objectives is left to the discretion of the instructor, according to predetermined objectives.

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Testing of knowledge should stress areas of clinical relevance over basic science. No matter what type of evaluation system is used, students should be kept informed of their progress and should be given additional activities to supplement weak areas.

As previously stated, the emphasis is on student competency, rather than on the total number of hours the student is involved in the program. Thus, it is possible for the student to be tested and given credit for any module. The medical director should not assume the student's competency simply because of prior training, but should develop an evaluation method to determine the student's proficiency based on first-hand observation and experience. With this type of method, it is possible for students to receive credit for prior training experience. This would be especially applicable for those modules that are primarily a review of skills concerned with Emergency Medical Technician-Ambulance; for example, soft-tissue injuries and rescue.

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MODULE VI CARDIOVASCULAR SYSTEM

INTRODUCTION

Prerequisites

The student must have successfully completed the following modules:

I. The Emergency Medical Technician, His Role, Responsibilities, and Training

II. Human Systems and Patient Assessment

III. Shock and Fluid Therapy

IV. General Pharmacology

V. Respiratory System

Description of Module

This module contains seven units:

Unit 1. Anatomy and Physiology: Discusses the anatomy and physiology of the cardiovascular system. It has no demonstrations or practice sessions. The lecture should take approximately 3 hours.

Unit 2. Patient Assessment: Discusses patient assessment for the cardiac patient. It has no demonstrations or practice sessions. The lecture should take approximately 1 hour.

Unit 3. Pathophysiology: Discusses pathophysiology. It contains no demonstrations or practice sessions. The lecture takes approximately 5 hours.

Unit 4. Reading and Understanding a Normal EKG: Discusses how to read and understand a normal electrocardiogram (EKG). It contains no demonstrations or practice sessions. The lecture takes approximately 1 hour.

Unit 5. Arrhythmia Recognition: Discusses arrhythmia recognition. It contains no demonstration sessions, but does have a student workbook exercise. These exercise sheets require that the instructor obtain actual EKG records (four records of each of the 16 arrhythmias discussed). The instructor should start to collect these EKG records as soon as possible. This unit takes approximately 5 hours, including the student exercises.

Unit 6. Techniques of Management: Discusses treatment of the arrhythmias, specifically cardiac drugs and the following skills:

- Cardiopulmonary resuscitation (CPR)
- EKG monitoring
- Defibrillation and cardioversion
- Rotating tourniquets
- *Carotid massage
- *Intercardiac injections
- *Use of mechanical CPR devices

Unit 7. Clinical Experience: Includes the following:

- Emergency department
- Intensive care unit/coronary care unit

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*Indicates optional skill.

UNIT 1 emt-p

ANATOMY AND PHYSIOLOGY

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Knowledge Objectives

After completing this module, the student should be able to correctly respond to at least 80 percent* of the following:

1.1.1.K Given a list of at least four systems or subsystems, the student should be able to correctly identify the two subsystems that compose the circulatory system (i.e., pulmonary and systemic).

1.1.2.K Given a list of at least four statements, the tudent should be able to correctly identify the statement(s) that describes the function of blood.

1.1.3.K Given a list of at least four statements, the tudent should be able to correctly identify the statement(s) that best describes the general function of the lymphatic system.

1.2.1.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that best describes the location and orientation of a normal adult heart.

1.3.1.K Given a list of at least four statements, the student should be able to correctly identify the statement that best describes and explains the:

*The selection of 80 percent as a passing criterion is arbitrary and can be modified.

- Comparative thickness of the walls of the atria and ventricles
- Relationship between the muscles in the atria and ventricles

1.4.1.K Given a diagram of a normal adult heart, the student should be able to indicate, either with arrows or by listing the structures (ventricle, mitral valve, etc.), the flow of blood.

1.4.2.K Given a list of at least four statements, the student should be able to correctly identify the statement that best describes the location(s) where the coronary arteries receive their supply of oxygenated blood.

1.6.1.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that best describes the function of the heart valves.

1.6.2.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that best describes how the aortic and pulmonary valves work.

1.6.3.K Given two lists, each consisting of at least four statements, the student should be able to correctly identify the two statements that describe the positions of the atrioventricular and semilunar valves when the atria and ventricles are relaxed.

1.6.4.K Given a list of at least four statements, the student should be able to correctly identify the statement that best describes the difference in structure between the semilunar and atrioventricular valves.

1.6.5.K Given a diagram of a normal adult heart and the following labels:

- Pericardium
- Epicardium
- Myocardium
- Right atrium
- Left atrium
- Endocardium
- Right ventricle
- Left ventricle

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- Interatrial septum
- Interventricular septum
- Superior vena cava
- Inferior vena cava
- Coronary sinus
- Tricuspid valve
- Mitral valve
- Pulmonary vein
- Pulmonary arteries
- Aortic valve
- Pulmonary valve
- Papillary muscle
- Apex and base

the student should be able to correctly locate each label on the diagram.

1.7.1.K Given two lists, each containing at least four statements, the student should be able to correctly identify the statements that define the properties of:

- Automaticity
- Rhythmicity

1.7.2.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that best describes how the heart muscles work.

1.7.3.K Given a list of at least four statements, the student should be able to correctly identify those statements that are true about the heart muscles.

1.7.4.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that describes the dominant pacemaker.

1.7.5.K Given three lists, each containing at least four rates per minute, the student should be able to correctly identify the intrinsic firing rates for the:

- Sinoatrial (SA) node
- Atrioventricular (AV) node
- Purkinje system

1.7.6.K Given a diagram of the electrical conduction system of the heart and the following labels:

- Sinoatrial node
- Internodal atrial pathway

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- Atrioventricular node
- Bundle of His
- Right and left bundle branches
- Atrioventricular junction
- Purkinje fibers

the student should be able to correctly attach the labels to the provided diagram.

1.7.7.K Given three lists, each containing at least four ranges in seconds, the student should be able to correctly identify the ranges it takes for an electrical impulse to travel:

- From the SA node to the AV node
- Through the AV node
- Through the bundle of His

1.7.8.K Given two lists, each containing at least four statements, the student should be able to correctly identify the statement that defines the:

- Depolarization process
- Repolarization process

1.7.9.K Given a list of at least four statements, the student should be able to identify the statements that best describe the process of depolarization and repolarization of a single myocardial fiber.

1.7.10.K Given two lists, each containing at least four statements, the student should be able to correctly identify the statements that best describe the:

- Absolute refractory period
- Relative refractory period

1.7.11.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that best describes what an electrocardiogram is.

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1.7.12.K Given three lists, each containing at least four statements, the student will be able to correctly identify the statement(s) that describes:

- P waves
- QRS complex
- T wave
- P-R interval
- R-R interval
- Isoelectric line
- S-T segment

1.7.13.K Given two lists, each containing at least four statements, the student should be able to correctly identify the statements that describe the effect on heart rate of stimulation of the:

- Sympathetic nervous system
- Parasympathetic nervous system

1.8.1.K Given three lists, each containing at least four statements, the student should be able to correctly identify the statements that define:

- Stroke volume
- Cardiac output
- Cardiac cycle

1.8.2.K Given a list containing at least four statements, the student should be able to correctly identify the statement that best defines Starling's law.

1.8.3.K Given a list containing at least four statements, the student should be able to select the statement that best describes what happens to cardiac output when either

- Stroke volume
- Heart rate

decreases or increases, given that the other parameter remains constant.

1.8.4.K Given a list containing four phrases, the student should be able to select the phrase that best describes what will

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happen to blood pressure when cardiac output and peripheral resistance vary.

1.8.5.K Given a list of at least four time periods in seconds, the student should be able to correctly identify the normal duration of a single cardiac cycle for a normal adult heart.

1.8.6.K Given two lists, each containing at least four statements, the student should be able to correctly identify the statements that define:

- Ventricular systole
- Ventricular diastole

1.8.7.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that best describes the association between ventricular diastole and systole and the operation of the atrioventricular valves.

1.8.8.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that describes what happens to the relaxation and contraction phases when heart rate increases.

1.9.1.K Given at least three lists, each containing four statements, the student should be able to correctly identify the statements that describe:

- Arteries
- Veins
- Capillaries

1.9.2.K Given a diagram of a human blood vessel system and the following labels:

- Ascending aorta
- Aortic arch
- Innominate artery and vein
- Subclavian artery and vein
- Axillary artery and vein
- Brachial artery

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- Radial artery
- Superior vena cava
- Inferior vena cava
- Common carotid artery
- Jugular vein
- Abdominal aorta
- Common iliac
- Femoral artery and vein

the student should be able to correctly locate each label on the given diagram.

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Instructor Activities

Inform the students that there are no demonstration and practice sessions involved in this unit.

Prior to this lesson, assign the following readings:

- Chapter 6, Unit 1, of the *Text*
- Any other reference material on the anatomy and physiology of the heart
- Knowledge objectives for this unit

Prepare a lecture on the anatomy and physiology of the heart following the content outline on page VI-11. The following suggestions are made:

- Introduce the general plan of the unit: Discuss the general purpose of the circulatory system, structure of the heart (including its electrical conduction system), and blood vessels.
- If available, use a model of the heart or a beef heart for Sections 1.2, 1.3, 1.5, and 1.6.
- If available, use a film or slides for Section 1.4.
- Delete Section 1.6 if you feel it is not important to have the students know and understand how valves work.
- When discussing Section 1.7, try to have heart muscle samples available. In addition, if available, use slides that illustrate the electromechanical conduction system of the heart and the polarization and depolarization of cardiac muscle.
- In discussing Section 1.8, give the students some in-class experience in understanding:

— Cardiac output = stroke volume × heart rate
— Blood pressure = cardiac output × peripheral resistance

These can be related to shock.

- In discussing Section 1.9, have an anatomical chart of the blood vessels.

Prepare a test using the specified behavioral objectives.

Test the students after they have had an opportunity to study the unit.

Equipment and Materials

Equipment—Educational

Chalkboard and chalk
Slide projector (if slides are used)
Film projector (if films are used)
Screen

Equipment—Medical

None

Materials

Knowledge objectives (optional)
Knowledge test
Text

Suggested Material

Model of the human heart
Beef heart
Cardiac muscle
Slides or films showing the flow of blood through the heart
Slides or films showing the electrical conduction system and an EKG record
An EKG record (one for every student)

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Content Outline

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Introduction

- Read the knowledge objectives.
- Discuss the general plan of presentation.

— Discuss the components of the circulatory system.
— Discuss the general purpose of the system.
— Discuss the heart.
  a. Location
  b. Size
  c. Shape
  d. Orientation
  e. Structure
  f. Flow of blood
  g. Muscles
  h. Electrical system
— Discuss blood vessels.
  a. Structure
  b. Systemic circuit (major blood vessels)

1.1. Circulatory system

A. Two main divisions
  1. Blood-vascular system
  2. Lymphatic system
B. Blood-vascular system—composition
  1. Heart (muscular organ) pumping action
  2. Blood vessels (two kinds)
    a. Vessels carrying blood from the heart
      (1) Arteries
      (2) Arterioles (smaller branches of arteries)
    b. Vessels carrying blood to the heart
      (1) Veins
      (2) Venules (smaller branches of veins)
  3. Capillaries
    a. Tiny blood vessels
    b. Function is to connect arterial and venous systems
    c. Capillary beds

C. Function—transportation of:
   1. Oxygen
   2. Nutrients
   3. Heat
   4. Wastes (metabolites, e.g., carbon dioxide)

D. Lymphatic system (review from Module II, Unit 2)
   1. Discuss the general function.
      a. Circulatory system
         (1) Point out that it is a "closed" fluid system.
         (2) Point out that some blood is lost in the capillary beds and cells.
      b. Lymphatic system
         (1) Point out that it returns some of the lost fluid to the bloodstream.
         (2) Point out that the locations of return are the right and left subclavian veins.
   2. Point out that the lymphatic system has no pumping mechanism as in the blood-vascular system.

1.2. Heart—general information (If available, use a model of the heart.)

A. Location
   1. Discuss the thorax region.
      a. Lungs
      b. Mediastinum (between the lungs)
         (1) Central area of the thorax region
         (2) Thoracic inlet to the diaphragm
         (3) Sections of the mediastinum
            (a) Superior mediastinum
            (b) Inferior mediastinum
               (i) Anterior
               (ii) Middle
               (iii) Posterior
   2. Point out that the heart is located in the middle
      a. In front of the esophagus and trachea
      b. In the diaphragm
      c. Between the lungs

B. Size
   1. Point out that it varies from individual to individual.

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2. Point out that it is approximately the same size as its owner's fist.
3. Discuss the approximate dimensions and weight.
   a. 10–12 centimeters (cm) long
   b. 9 cm wide
   c. 6 cm thick
   d. Weight
      (1) Males, 300 grams (g)
      (2) Females, 250 g

C. Shape
1. Point out that it is cone shaped (inverted in the mediastinum).
2. Discuss labels.
   a. Top part is the base (base of cone).
   b. Bottom part is the apex (pointed part).

D. Orientation
1. Heart is slightly rotated to the left.
2. Orientation is explained in relation to the position of the chambers (see orientation of the chambers, below).

1.3. Structure of the heart (If available, use anatomic charts.)

A. Pericardium and heart walls
1. Heart is contained in a double-walled sac called the pericardium.
   a. Discuss the two layers of the pericardium.
      (1) Outer layer—parietal pericardium
      (2) Inner layer—visceral pericardium
   b. Discuss the space between the two layers.
      (1) Point out that it is filled with pericardium fluid.
      (2) Point out that the fluid serves as a lubricant.
   c. Discuss the parietal pericardium (two layers).
      (1) Outer layer—fibrous layer
      (2) Inner layer—serous layer
   d. Point out that the pericardium is anchored in the mediastinum.
      (1) Point out that it is at the inferior portion anchored to superior surface of the diaphragm.
      (2) Point out that the central tendon of the diaphragm is the point of anchor.

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(3) Point out that it is fused to the undersurface of the sternum by fibrous material.
(4) Point out that the pericardium is not free to move in the mediastinum.

2. Walls of the heart consist of three layers.
   a. Outer layer
      (1) Epicardium
      (2) Same as visceral pericardium
      (3) Elastic fibers
      (4) Some fat deposits
   b. Middle layer
      (1) Discuss the myocardium.
      (2) Point out that it is composed of muscle fibers.
      (3) Point out that it is a relatively thick layer.
      (4) Point out that thickness varies by chamber.
   c. Inner layer
      (1) Discuss the endocardium.
      (2) Point out that it is composed of connective tissue.

B. Heart chambers (If available, use a model heart or beef heart.)
   1. Name
      a. Right and left atria
      b. Right and left ventricles
         (1) Larger than atria
         (2) More muscular than atria
   2. Location
      a. Atria
         (1) Superior portion of heart
         (2) Right and left superior portion
      b. Ventricles
         (1) Inferior portion of heart (apex)
         (2) Right and left inferior portion
   3. Orientation of the heart and chambers
      a. Point out that the heart is slightly rotated.
      b. Point out that the right side of the heart is anterior to the left side of the heart.
      c. Point out that the right atrium is anterior to the left atrium.
      d. Point out that the right ventricle is anterior to the left ventricle.

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e. Point out that the atria is approximately on the same plane.
f. Discuss the axis of heart orientation.

4. Separation
   a. Discuss external separation
      (1) Atrioventricular groove separates the atria from the ventricles.
      (2) Anterior and posterior interventricular groove separates the ventricles.
   b. Discuss internal separation
      (1) Interatrial septum separates the atria.
      (2) Interventricular septum separates the ventricles.
   c. Point out that the chambers function independently in terms of contraction (like two pumps).

5. Walls
   a. Point out that they are composed of epicardial, myocardial, and endocardial tissue.
   b. Discuss atria (myocardial tissue).
      (1) Point out that they are thin walled compared to ventricles.
      (2) Point out that they contain less pressure than the ventricles.
      (3) Discuss pressure changes.
   c. Discuss ventricles (myocardium).
      (1) Point out that they are thick walled compared to atria.
      (2) Point out that they contain more pressure than the atria.
      (3) Discuss pressure changes.
      (4) Discuss the left ventricle.
         (a) Thicker walled than the right ventricle
         (b) Contains more pressure than the right ventricle
   d. Point out that the thickness is due to myocardium (muscle tissue).
   e. Point out that the muscles of the atria and ventricles are not continuous.
      (1) Point out that this is why the chambers work independently.

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(2) Point out that between them is the fibrous skeleton of the heart.
(a) Serves as an anchor of muscle
(b) Facilitates muscle contraction

f. Discuss the endocardium layer.
(1) Point out that it is constructed of valves.
(2) Point out that it is attached to muscle fibers.

1.4. General plan of circulation through the heart (If available, use slides.)

A. Discuss the right side of the heart.
1. Point out that unoxygenated blood enters the right atrium from:
a. Superior vena cava (vein)
(1) Located at the right side of the heart
(2) Drains unoxygenated blood from the upper body
b. Inferior vena cava (vein)
(1) Located at the right side of the heart
(2) Drains unoxygenated blood from the lower part of body
c. Coronary sinus
(1) Located in the right atrium
(2) Drains blood from the heart itself
2. Point out that the right atrium contracts.
a. Unoxygenated blood enters the right ventricle through an atrioventricular valve.
(1) Valve is called the tricuspid valve (discussed more extensively in the next section)
(2) Valve is only open when the ventricle is relaxed
b. Right ventricle fills with unoxygenated blood.
3. Point out that the right ventricle contracts.
a. Tricuspid valve closes so no blood backflows to the right atrium.
b. Unoxygenated blood enters the pulmonary arteries through the valve.
(1) Valve is called the pulmonic valve (discussed more extensively in the next section)
(2) Valve opens when the ventricle contracts

NOTES

c. Pulmonary arteries are located at the base of the heart.

B. Discuss pulmonary or lesser circulation.
   1. Point out that this is usually a low-pressure system.
   2. Point out that unoxygenated blood enters the lungs from the pulmonary arteries (left and right arteries).
   3. Point out that in the lungs:
      a. Unoxygenated blood becomes oxygenated
      b. Carbon dioxide is given up
   4. Point out that after blood is reoxygenated in the lungs, it enters the pulmonary veins.
      a. Travels back to the heart
      b. Enters the left atrium

C. Point out that the left atrium contracts.
   1. Reoxygenated blood enters the left ventricle through an atrioventricular valve.
      a. Valve is called the mitral valve
      b. Valve opens when the left ventricle is relaxed

D. Point out that the left ventricle contracts.
   1. Mitral valve closes to prevent a backflow of blood to the left atrium.
   2. Reoxygenated blood enters the aorta through a valve.
      a. Valve is called the aortic valve
      b. Valve opens when the ventricle contracts

E. Discuss systemic circulation or greater circulation
   1. Point out that reoxygenated blood flows through the aorta into:
      a. Coronary arteries (discussed later)
      b. Systemic arteries, arterioles, capillaries
   2. Point out that in capillary bed:
      a. Oxygen and nutrients are given to tissue
      b. Carbon dioxide and other wastes are picked up
      c. Discuss pressures
         (1) Pressure differences allow for cell profusion and fluid control.
         (2) Too little pressure causes a lack of profusion and, therefore, no nutrition.
         (3) Too much pressure causes edema.
   3. Point out that unoxygenated blood travels through venules and veins, terminating in:

NOTES

a. Superior vena cava
b. Inferior vena cava

F. Point out that the procedure is repeated.
1. Unoxygenated blood enters the right atrium.
2. The process continues.

NOTES

1.5. Some comments about circulation

A. Point out that the heart is really two pumps in one organ.
1. Right side pumps unoxygenated blood into the pulmonary circuit.
2. Left side pumps oxygenated blood into the systemic circuit.
3. Blood is never directly exchanged between the right and the left sides.
4. The two sides work in parallel.

B. Discuss the principal function of circulation (recall).
1. To carry oxygen and nutrients to the body tissue
2. To carry carbon dioxide and other wastes from the body tissue

C. Discuss observation.
1. Pulmonary artery carries unoxygenated blood
2. Pulmonary vein carries oxygenated blood

1.6. More about the heart valves (If available, use slides.)

A. Four valves (review)
1. Atrioventricular valves
a. Between the right atrium and ventricle
(1) Called the tricuspid valve
(2) Called the tricuspid because it has three cusps
b. Between the left atrium and ventricle
(1) Called the mitral valve
(2) Has only two cusps
2. Semilunar valves
a. Between the right ventricle and pulmonary trunk—called the pulmonic valve
b. Between the left ventricle and aorta—called the aortic valve

B. Structure of valves
1. Point out that they are composed of endocardium and connective tissue.

2. Discuss atrioventricular valves (thin walled)
   a. Tricuspid valve
      (1) Point out that it has three cusps or leaflets.
      (2) Point out that it is located at the atrioventricular opening.
      (3) Point out that a base of leaflets forms a ring around the opening.
      (4) Point out that free edges project inferiorly into the ventricular cavity.
      (5) Point out that free edges are attached to chordae tendineae, which are:
         (a) Attached to papillary muscles and the edges of valve leaflets
         (b) Stringlike in shape
      (6) Discuss papillary muscles
         (a) Point out that they are projections from ventricle.
         (b) Point out that they anchor the leaflets.
   b. Mitral valve
      (1) Same basic structure as the tricuspid valve
      (2) Has only two leaflets
   c. Function
      (1) Point out that the function of valves is to stop the flow of blood back into the atria.
      (2) Discuss how they work
         (a) Point out that when the ventricle relaxes, the valve is open.
         (b) Point out that when the ventricle contracts, the valve is closed.
         (c) Point out that closing is caused by the papillary muscle contracting; that is, the muscle pulls down on the valve leaflets.
         (d) Point out that the papillary muscle contracts before the muscles in the ventricle.
         (e) Point out that pressure during ventricular contraction helps to keep the valves closed.
3. Semilunar valves
   a. Aortic and pulmonary valves
   b. Structure is different from atrioventricular valves
      (1) Three pocket-shaped flaps
      (2) Lower and upper border

NOTES

(a) Lower border is attached to the wall of the aorta and pulmonary arteries

(b) Upper border is free to swing

c. Function

(1) Point out that it is to stop the flow of blood back into the ventricles.

(2) Discuss how the valves work.

(a) Point out that the pockets fill and then close.

(b) Point out that when the ventricles contract, the valves open (by pressure).

(c) Point out that when the ventricles relax, blood in the vessels creates back pressure and the pockets fill and close.

(d) Discuss low-pressure valves.

(3) Point out the special features of the aortic valve.

(a) Point out that behind two of the lids are openings.

(b) Point out that the openings lead to the coronary arteries.

(c) Point out that when the valve is open, blood does not go to the coronary artery.

(d) Point out that when the valve is closed, blood enters the coronary artery.

1.7. Heart muscle contraction

A. Properties of cardiac muscles

1. Point out that they are made of fibers (long, rod shaped).
2. Point out that they are striated, but less pronounced.
3. Point out that the nuclei are centrally located.
4. Point out the important concepts.
   a. Muscles work as a unit and not individually.
   b. Muscles are combined to transmit an electrical impulse.
   c. As one cell contracts, the adjacent cells contract.
5. Point out that they respond to such stimuli as:
   a. Thermal
   b. Electrical

NOTES

c. Chemical
d. Mechanical

6. Point out that they have the following properties:
   a. Irritability
   b. Conductivity
   c. Elasticity
   d. Automaticity
      (1) Not only the heart as a whole, but a small portion of it automatically contracts without electrical impulses.
      (2) A piece of muscle outside the body will contract (automatically) without stimulation.
   e. Rhythmicity
      (1) Regular beat of the heart
      (2) Coordination of the contractions of all muscles (If each muscle cell fires independently, there will be no smooth systematic rhythm.)
      (3) Rhythm of the fastest cell is not the rhythm of another

B. Electrolyte balance
   1. Point out that rhythmic contraction and relaxation depend on the balance of ions in the blood and tissue fluid.
      a. Calcium
      b. Sodium
      c. Potassium
   2. Discuss the effects of an imbalance.
      a. Calcium excess—heart will stop contractions; the calcium deficit increases cardiac irritability and the tendency to fibrillate.
      b. Sodium excess—heart becomes progressively weaker and finally stops during relaxation.
      c. Potassium excess—same effect as sodium; potassium deficit increases irritability and the tendency to fibrillate.

C. Electromechanical system of the heart
   1. Point out that it causes the heart muscle to beat at a regular pace.
   2. Point out that it causes the atria and ventricles to contract in coordination.

NOTES

3. Discuss parts of the system.
   a. SA node
      (1) Point out that it is the dominant pacemaker.
      (2) Point out that it is located in the right atrium entrance to the superior vena cava.
      (3) Point out that it is composed of specialized muscle cells that have the fastest spontaneous rhythm (and it sets the pace for other cells).
   b. Internodal atrial pathways connect the SA node to the AV node.
   c. AV node
      (1) Discuss the AV junction
      (2) Point out that it is near the coronary sinus.
      (3) Point out that it conducts electrical impulses to the ventricle.
      (4) Recall that atria muscles and ventricular muscles are not in direct contact with each other.
   d. Atrioventricular bundle (bundle of His)
      (1) Point out that it is located at the top of the interventricular septum.
      (2) Point out that it is the conduction system to ventricles.
   e. Bundle branches
      (1) Discuss the right bundle branch.
      (2) Discuss the left bundle branch.
      (3) Point out that extending from the branches are:
         (a) Purkinje fibers
         (b) Purkinje network
4. More comments about the system
   a. Point out that the SA node is the dominant pacemaker.
   b. Point out that any other part of the system can act as a pacemaker.
   c. Discuss intrinsic rates of discharge:
      (1) SA node = 60–100/minute (min)
      (2) AV node = 45–55/min
      (3) Purkinje system = 30–40/min
   d. Discuss the travel of impulses
      (1) Point out that the SA node fires first (normally).

NOTES

(2) Point out that impulses travel through internodal pathways in 0.08-second impulses to reach the AV node.

(3) Point out that an impulse goes through the AV node in 0.08 to 0.16 second.

(4) Point out that an impulse enters the bundle of His.

(5) Point out that it travels through the bundle of His in 0.03 to 0.05 second.

(6) Point out that it ends in the Purkinje network.

e. Discuss note on travel of impulses

(1) Impulse reaches the papillary muscles

(2) Papillary muscles must contract before the rest of the ventricles

(3) Valve must be closed before the ventricle contracts

5. Depolarization and repolarization

a. Define depolarization as the process by which the heart is stimulated to contract.

b. Define repolarization as the process by which the heart is recharged and capable of stimulation.

c. Discuss individual myocardial fiber (drawing a diagram of an individual cell).

(1) Surface at rest (polarized) is positive

(2) Within fiber the charge is negative

(3) Electrical stimulus reverses the charges

(a) Stimulated surface becomes negative

(b) Stimulated interior becomes positive

(c) Stimulus starts at one point, wave moves through fiber until the interior is all positive

(d) Start of the wave is depolarization

(e) Complete fiber then contracts

(f) After contraction, a charge (negative) goes through the fiber in the opposite direction (repolarization)

d. Point out that during repolarization:

(1) Fiber cannot respond to stimulus—called absolute refactory period

(2) When repolarization nears completion, the fiber can be stimulated to contract prematurely—called the relative refactory period

NOTES

e. Point out that each myofibril is stimulated and reacts separately; the combined action produces the electromuscular activity.
   (1) Depolarization and repolarization can be sensed on the surface of the body skin by electrodes.
   (2) If an electrical impulse is amplified, it can be recorded.
   (3) A record of electrical activity in the heart is known as an EKG.

6. Discuss mechanical activity versus electrical activity.

D. EKG record
1. Discuss the composition (describe each one and give an example).
   a. P waves
   b. QRS complex
   c. T waves
   d. P-R interval
   e. R-R interval
   f. S-T segment
   g. Isoelectric line
2. Point out that P waves are a depolarization of the atria.
3. Point out that the QRS complex is a depolarization of the ventricles.
4. Point out that repolarization of both the atria and ventricles causes the formation of:
   a. Atrial T wave—usually not visible
   b. Ventricular T wave

E. Nervous control
1. Autonomic nervous system
   a. Parasympathetic—function
   b. Sympathetic—function
2. Parasympathetic nervous system
   a. Vagus nerve
   b. Acetylcholine
   c. Stimulation of:
      (1) Carotid sinus pressure
      (2) Valsalva maneuver
      (3) Straining to move the bowels
      (4) Distention of bladder

NOTES

d. Effect—slows heart by depressing the pacemaker sites (discuss blockers)

3. Sympathetic nervous system
   a. Nerves arising in thoracic and lumbar ganglia
   b. Norepinephrine
   c. Adrenal gland
   d. Sympathetic agents
      (1) Alpha
      (2) Beta
4. Alpha agents
   a. No effect on the heart
   b. Vasoconstriction
   c. Bronchoconstriction
5. Beta agents
   a. Heart increase rate and contractability
   b. Increase irritability
   c. Dilate bronchi

1.8. Function of heart

A. Some terms
   1. Cardiac output
      a. Define it as the amount of blood pumped through the circulatory system per minute.
      b. Discuss the computation.
         (1) Stroke volume is the volume of blood pumped out of the ventricle with each contraction.
         (2) Cardiac output = stroke volume × heart rate per minute (give an example of computations)
      c. Point out that stroke volume is about 60–100 milliliters; however, the capacity of the ventricle is much higher.
         (1) Capacity of the ventricle is 100–150 milliliters.
         (2) Not all blood is discharged from the ventricle (about 20 percent is not pumped out). May vary; if the ventricle is not relaxed, it will not fill to capacity (particularly as heart beats faster).
      d. Heart rate
         (1) Discuss beats per minute.

NOTES

(2) Discuss that it varies due to situations.
(a) Exercise—greater heart rate
(b) Rest—lesser heart rate

e. Starling's law: stretching causes contraction with greater force, thus putting out a larger stroke volume.

f. Blood pressure
(1) Sympathetic control
(2) Blood pressure = cardiac output × peripheral resistance

2. Cardiac cycle
a. Point out that contraction and relaxation alternate rhythmically.
b. Define contraction as systole (of the ventricle).
c. Define relaxation as diastole (of the ventricle).
d. Relate systole and diastole to:
(1) EKG
(2) Depolarization and repolarization
e. Discuss systole—peak pressure of contraction is about 0.28 second.
f. Discuss diastole—0.52 second (relaxes longer).
g. Define cardiac cycle as the interval between two beats—about 0.28 + 0.52 = 0.80 second.
(1) When there is an increase in the heart rate, there is a decrease in the relaxation phase (less ventricle filling).
(2) There is little reduction in systolic time.

B. Heart sound (pressure)
1. Sounds are related to the valves opening and closing.
2. At systole, AV valves are closed as the diastole AV valves close.
3. First sound begins at the systole.
4. Second sound is the closure of the semilunar valves.
5. Sounds are associated with the closure of valves during the beginning and end of systole.
6. Sound is the movement of fluid, not the physical closing of valves.

1.9. Blood vessels

A. Review
1. Arteries carry blood from the heart.

NOTES

2. Veins carry blood to the heart.
3. Capillaries connect the arteries and veins (exchange system).

B. Some comments
   1. Venous system
      a. Point out that it contains valves (one-way flow).
      b. Point out that 80 percent of the blood is in the veins; the system serves as a blood pool.
   2. Arterial system
      a. Point out that it has no valves.
      b. Point out that about 15 percent of the blood is in the arteries.
      c. Point out that 5 percent of the blood is in the capillaries.

C. Structure of vessel walls
   1. Three layers
      a. Inner layer
         (1) Discuss the tunica intima.
         (2) Discuss the lining of the vessels.
         (3) Point out that it is thin and smooth.
      b. Middle layer
         (1) Discuss the tunica media.
         (2) Point out that it is the thickest layer.
         (3) Point out that it contains elastic membrane and muscle cells.
      c. Outer layer
         (1) Discuss the tunica adventitia.
         (2) Point out that it consists of fibrous connective tissue.
         (3) Point out that it gives vessel strength.
      d. Lumen—cavity of vessel
   2. Arteries and wall structure
      a. Large arteries (e.g., aorta)
         (1) Their principal function is conduction.
         (2) Elastic tissue predominates in the tunica media.
      b. Middle size to small arteries (e.g., arterioles)
         (1) Their principal function is distribution and control of flow.
         (2) Muscular fiber predominates, especially in smaller vessels.
   3. Capillaries
      a. Define them as the termination of arterioles.

NOTES

b. Point out that they have a small thin wall (tunica intima)—no muscle tissue.
c. Point out that the lumen is small (only large enough for corpuscles to pass in single file).

4. Venules (smallest veins)
   a. Larger lumen
      (1) Low pressure
      (2) Large pool of blood
   b. Indistinguishable three layers
5. Veins
   a. Relatively thin wall compared to arteries
   b. Relatively indistinguishable layers compared to arteries
   c. Types
      (1) Deep
      (2) Superficial
      (3) Portal

D. Coronary circulation (use charts, if available)
   1. Coronary arteries
      a. Originate from the base of the ascending aorta
      b. Are above the leaflets of the aortic valve
      c. Provide blood supply to the cardiac muscle
   2. Left coronary artery branches
      a. Anterior descending branch
      b. Circumflex branch
   3. Right coronary artery branches into the posterior descending branch
   4. Coronary sinus
      a. Returns the blood
      b. Empties into the right atrium

E. Systemic circuits (use anatomic charts)
   1. Circuit through the heart
      a. Aorta
      b. Coronary arteries
      c. Capillaries in the wall of the heart
      d. Cardiac veins
      e. Coronary sinus
      f. Right atrium
   2. Circuit through upper extremity
      a. Ascending aorta

NOTES

b. Arch of the aorta
c. Innominate artery
d. Subclavian artery
e. Axillary artery
f. Brachial artery
g. Radial artery
h. Other arterioles
i. Capillaries
j. Venules
k. Axillary vein
l. Subclavian vein
m. Innominate vein
n. Superior vena cava
o. Right atrium

3. Circuit through the head and neck
   a. Ascending aorta
   b. Arch of the aorta
   c. Subclavian and right common carotid arteries
   d. Internal and external carotid arteries
   e. Small arteries and arterioles
   f. Capillaries
   g. Internal and external jugular veins
   h. Subclavian vein
   i. Innominate vein
   j. Superior vena cava
   k. Right atrium
4. Circuit through the thorax
5. Circuit through the digestive organs and liver
6. Circuit through the kidney
7. Circuit through the lower extremities
   a. Ascending aorta
   b. Aortic arch
   c. Thoracic aorta
   d. Abdominal aorta
   e. Common iliac
   f. Femoral artery
   g. Small arteries and arterioles
   h. Capillaries
   i. Femoral vein
   j. External and internal iliac veins

NOTES

k. Common iliac vein
l. Inferior vena cava
m. Right atrium

NOTES

Summary

- Circulatory system
- Structure and function of the heart
- Systemic and pulmonary circulation
- Electrical activity of the heart
- Heart sounds
- Arteries, veins, and the circulatory system

UNIT 2 emt-p

PATIENT ASSESSMENT

Knowledge Objectives

After completing this module, the student should be able to correctly respond to at least 80 percent* of the following:

2.1.1.K The student should be able to list at least four chief complaints of the cardiac problem patient.

2.1.2.K Given a list of chief complaints of the patient suffering from cardiac problems, the student should be able to list at least five questions for each complaint that needs to be answered.

2.1.3.K Given a list of at least four statements, the student should be able to select the statement that best describes why dyspnea might occur in a patient with cardiac problems.

2.1.4.K Given a list of at least four statements, the student should be able to select the statement that best describes why syncope might occur in patients with cardiac problems.

2.2.1.K The student should be able to list at least four questions to ask when taking a past medical history from a potential cardiac problem patient.

2.2.2.K Given a list of drugs, the student should be able to select those drugs that a suffering patient might be taking for cardiovascular problems.

NOTES

*The selection of 80 percent as a passing criterion is arbitrary and can be modified.

2.3.1.K Given a list of at least four statements, the student should be able to select the statement(s) that best describes what special aspects to be aware of when doing a physical examination of a potential cardiac patient.

NOTES

Instructor Activities

Assign the material referred to below during the class period immediately before beginning this unit:

- Chapter 6, Unit 2, of the *Text*
- Knowledge objectives for this unit

Inform the students that there are no demonstration or practice sessions involved in this unit.

Prepare a lecture following the content outline below. Inform the students that this is a brief orientation; in later units we will discuss the signs and symptoms of specific cardiac problems.

Prepare a written test using the specified knowledge objectives associated with this unit.

Test the students.

Equipment and Materials

Equipment—Educational

Chalkboard and chalk

Equipment—Medical

None

Materials

Text
Knowledge objectives (optional)
Knowledge test (to be prepared by instructor)

Content Outline

Introduction

- Have the students read the knowledge objectives for this unit.
- Explain the purpose of this unit:

— To learn how to obtain a patient history of the cardiac patient

— To learn how to conduct a physical examination of the cardiac patient

NOTES

2.1. History in the cardiac patient

A. Chief complaints

1. Chest pain—determine:
   a. Location of pain
   b. When it started
   c. Duration
   d. Severity
   e. Associated symptoms (nausea and sweating)
   f. Any alleviating factors
   g. Any medication taken to relieve pain
   h. What caused the pain to start
   i. If the patient experienced any similar pain before
2. Dyspnea
   a. Relate cause to physiology (e.g., congestive heart failure, where blood fills the alveoli)
   b. Point out that the emergency medical technician (EMT) must determine the following:
      (1) When did dyspnea start?
      (2) Does any body position make the dyspnea better or worse?
      (3) Has it ever happened to the patient before: if so, under what circumstances?
      (4) Are there any associated symptoms?
   c. Point out that dyspnea has a variety of causes, some unrelated to heart problems. Thus, you should inquire about other possible causes, including chronic pulmonary problems.
3. Fainting or syncope
   a. Discuss possible cause—reduction in cardiac output and consequent reduction in perfusion of the brain.
   b. Point out that the EMT must determine:
      (1) Under what circumstances did the fainting occur?
      (2) Did fainting spell occur with or without warning?

(3) In what position did it happen?
(4) Has it ever happened before?
(5) Are there any associated symptoms?

4. Palpitations
   a. Define as abnormal awareness of one's heartbeat; "skip a beat"
   b. Point out that the EMT must determine:
      (1) When the onset occurred
      (2) Frequency
      (3) Duration
      (4) If there were any previous episodes
      (5) If there are any associated symptoms

2.2. Past medical history

A. Determine the following:
   1. Is the patient taking any medication regularly, for example:
      a. Nitroglycerin
      b. Digitalis
      c. Diuretics
      d. Quinidine
      e. Procainamide
      f. Propranolol
   2. Is the patient under treatment for any serious illness?
   3. Has the patient ever been known to have:
      a. Hypertension
      b. Diabetes
      c. Previous heart attack or heart failure
      d. Rheumatic fever
      e. Lung disease
   4. Does the patient have any known allergies (e.g., to numbing medicines)?

2.3. Physical examination of the cardiac patient

A. Do a fundamental survey and secondary surveys.
B. Take special note of the following:
   1. State of consciousness
      a. Brain perfusion
      b. Stupor or confusion

NOTES

2. Rate and quality of pulse
3. Color and temperature of skin—peripheral perfusion
4. Jugular vein distention—discuss what might cause distention
5. Lung sounds
   a. Significance of rales and wheezes
   b. Third heart sound
6. Examination of back and extremities for edema—relate to right heart failure

NOTES

Summary

- Chief complaints
  - — Chest pain
  - — Dyspnea
  - — Fainting or syncope
  - — Palpitations
- Past medical history
  - — Medications
    a. Nitroglycerin
    b. Digitalis
    c. Diuretics
    d. Procainamide
    e. Propranolol
  - — Under treatment for serious illness
  - — Past problems
    a. Hypertension
    b. Diabetes
    c. Previous heart attack or heart failure
    d. Rheumatic fever
    e. Lung disease
  - — Any known allergies
- Physical examination
  - — State of consciousness
  - — Pulse
  - — Skin

— Jugular vein distention
— Wheezes and rales
— Edema

NOTES

UNIT 3 emt-p

PATHOPHYSIOLOGY AND MANAGEMENT OF CARDIOVASCULAR PROBLEMS

NOTES

Knowledge Objectives

After completing this module, the student should be able to correctly respond to at least 80 percent* of the following:

3.2.1.K Given a written question, the student should be able to correctly list at least eight risk factors associated with coronary artery disease.

3.2.2.K Given a list of at least four statements, the student should be able to correctly define those statements that are true about the atherosclerotic process.

3.2.3.K Given a list of at least four characteristics, the student should be able to correctly identify the characteristics of pain associated with angina pectoris.

3.2.4.K Given a list of at least four characteristics, the student should be able to correctly identify the characteristics of the pain associated with an acute myocardial infarction.

3.2.5.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that explains why coronary arteries are prone to atherosclerosis.

*The selection of 80 percent as a passing criterion is arbitrary and can be modified.

NOTES

3.2.6.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that explains what collateral circulation achieves during the process of atherosclerosis.

3.2.7.K Given a list of at least four treatments, the student should be able to correctly identify the treatment for angina pectoris.

3.2.8.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that describes the effects of nitroglycerin.

3.2.9.K Given a list of at least four statements, the student should be able to identify the statement that best defines either stable or unstable angina.

3.2.10.K Given a list of statements, the student should be able to identify the statements that best describe the following:

- Intensity of pain
- Duration of pain
- Precipitating factors
- Relieving factors
- Effects of nitroglycerin
- Associated symptoms

for both angina and acute myocardial infarction (AMI).

3.2.11.K Given a list of at least four statements, the student should be able to identify those statements that best describe the symptoms associated with AMI.

3.2.12.K Given a list of phrases or statements, the student should be able to identify those phrases and statements that describe the signs of AMI.

3.2.13.K When asked, the student should be able to list the steps in treating or managing uncomplicated AMI.

NOTES

3.2.14.K Given a list of at least four statements, the student should be able to identify the statement(s) that best describes the pathophysiology of left congestive heart failure.

3.2.15.K Given a list of phrases or statements, the student should be able to identify the statement(s) that best describes the signs and symptoms of right congestive heart failure.

3.2.16.K Given various lists of reasons, the student should be able to select the reasons why the following will occur in a patient with left congestive heart failure:

- Dyspnea
- Rales and wheezes
- Blood-tinged sputum

3.2.17.K When asked, the student should be able to list the steps involved in the treatment of left congestive heart failure.

3.2.18.K Given a list of reasons for each of the following items, the student should be able to select the reasons why the following treatments are recommended for patients with left congestive heart failure:

- Positive-pressure oxygen administration
- Putting the patient in a sitting position
- Rotating tourniquets

3.2.19.K Given a list of drugs, the student should be able to identify those drugs that might be used to treat a patient with left congestive heart failure.

3.2.20.K Given a list of at least four causes, the student should be able to identify the most common cause of right congestive heart failure.

3.2.21.K Given a list of events, the student should be able to identify the events occurring in right congestive heart failure.

3.2.22.K Given a list of signs and symptoms, the student should be able to identify the signs and symptoms of right congestive heart failure.

3.2.23.K Given a list of reasons, the student should be able to identify the reason jugular vein distention occurs in right congestive heart failure.

3.2.24.K Given a list of at least four statements, the student should be able to identify why left heart failure might improve if right heart failure occurs.

3.2.25.K Given lists of statements, the student should be able to identify the statements that best define:

- Ventricular aneurysm
- Cardiac rupture
- Cardiogenic shock
- Hypertension
- Syncope

3.2.26.K Given a list of signs and symptoms, the student should be able to select the signs and symptoms associated with cardiogenic shock.

3.2.27.K When asked, the student should be able to list the steps involved in treating cardiogenic shock.

3.2.28.K When asked, the student should be able to list the steps involved in treating syncope resulting from any cause.

3.2.29.K When asked, the student should be able to list the steps involved in treating acute hypertensive crisis.

Instructor Activities

Assign the material referred to below during the class period immediately before beginning this unit:

- Chapter 6, Unit 3, of the *Text*
- Knowledge objectives for this unit

NOTES

Inform the students that there are no demonstrations or practice sessions associated with this unit.

Prepare a lecture following the content outline on page VI-42. The following suggestions are made:

- In Section 3.2 of the outline, try to use the following visual aids, if available:
  - — Sample of a diseased artery to illustrate atherosclerosis
  - — Sample of diseased hearts (e.g., AMI)
- When developing angina and AMI's, try to develop a chart on the board that describes the differences in signs and symptoms, using the following:
  - — Intensity of pain
  - — Duration of pain
  - — Precipitating factors
  - — Relieving factors
  - — Effects of nitroglycerin
  - — Associated symptoms

Prepare a written test using the specified objectives.
Test the students.

Equipment and Materials

Equipment—Educational

Chalkboard and chalk

Equipment—Medical

None

Materials

Knowledge objectives (optional)
Text
Knowledge test (to be prepared by instructor)

NOTES

Suggested Materials (if available)

Anatomical samples
Diseased artery
Diseased hearts

Content Outline

Introduction

- Explain the purpose of this unit—to expose the student to the following and to discuss possible treatments for:
  - — Coronary artery disease
  - — Angina
  - — Acute myocardial infarction
  - — Congestive heart failure
    - a. Right
    - b. Left
  - — Cardiogenic shock
  - — Syncope
  - — Myocardial trauma
  - — Hypertension
- Have the students read the knowledge objectives.

3.1. Introduction (review)

A. Recall
1. Coronary arteries originate from base of ascending aorta above the leaflets in the aortic valve.
2. Coronary arteries carry oxygenated blood to the heart muscles.

B. Coronary circulation
1. Left coronary artery branches
   a. Anterior descending branch
   b. Circumflex branch
2. Right coronary artery branches into the posterior descending branch.
3. Coronary sinus

3.2. Diseases to coronary arteries and other heart problems

A. Arteriosclerosis

NOTES

1. Common term for several kinds of degenerative arterial disease
2. Often referred to as "hardening of the arteries"
3. Can affect any artery in the body

B. Atherosclerosis (intimal layer)
   1. Discuss the common type of arteriosclerosis.
   2. Point out that it affects:
      a. Aorta and its main branches
      b. Cerebral arteries
      c. Coronary arteries
   3. Point out that coronary arteries are particularly prone to:
      a. Constant bending
      b. Mechanical process
   4. Discuss the risk factors.
      a. Sex (male)
      b. Race (Caucasian)
      c. Body build (heavy and muscular)
      d. Elevated serum cholesterol
      e. Diabetes
      f. Dietary habits
      g. Hypertension
      h. Cigarette smoking
      i. Aggressive competitive personality
      j. Stress occupation
      k. Sedentary existence
   5. Discuss the process of atherosclerosis.
      a. Point out that it is a gradual process, causing obstruction and hardening of the arterial walls.
      b. Point out that small deposits of cholesterol and lipids form on the intima of the coronary arteries, usually around the attachment of the platelet or recent blood clot.
      c. Point out that the deposits enlarge.
      d. Point out that these irritations of arterial tissue cause proliferation of capillaries, followed by:
         (1) Inflammation
         (2) Swelling
         (3) Scar formation (fibrosis)
      e. Discuss calcification.
      f. Point out that during the inflammation process:

NOTES

(1) Capillaries can rupture.
(2) Ruptures form blood clots and further obstruction.

g. Discuss the final result.
(1) Intima becomes thick and hard and completely inelastic.
(2) Blood flow is severely reduced.

h. Discuss collateral circulation
(1) When an obstruction is present, interconnecting arteries dilate.
(2) Dilated vessels provide an alternate route for blood.

i. Discuss the early stages of atherosclerosis.
(1) Asymptomatic
(2) No pain, if moderate obstruction and collateral circulation is sufficient to serve myocardium

j. Discuss the late stages of atherosclerosis.
(1) Coronary arteries cannot supply enough oxygen to myocardium.
(2) This phenomenon usually produces pain.

C. Angina pectoris

1. Define it as pain or choking in the chest caused by a temporary lack of oxygen (ischemia) in the myocardium tissue.
a. Build up of carbon dioxide
b. Build up of lactic acid

2. Point out that it is usually behind the middle or upper sternum (substernally).

3. Point out that pain radiates to:
a. Upper extremities (usually left)
b. Shoulders and down extremity
c. Neck, jaw, and teeth
d. Upper back
e. Upper middle of abdomen

4. Point out that the patient usually refers to the pain as:
a. Pressure
b. Tightness
c. Squeezing
d. Indigestion

5. Point out that the pain is not influenced by breathing, coughing, or body movement.

NOTES

6. Point out that the pain usually lasts 3 to 5 minutes (however, it can last longer—almost 30 minutes).
7. Point out that it usually follows emotional or physical stress and can occur during sleep.
8. Point out that nitroglycerin will result in relief in:
   a. Dilating the coronary arteries
   b. Lowering the blood pressure
9. Point out that it is sometimes confused with:
   a. Gallbladder attack
   b. Hiatus hernia
   c Indigestion
10. Point out that there are two types:
   a. Stable (predictable)
   b. Unstable (unpredictable)

D. Acute myocardial infarction
   1. Define as occurring when the heart muscle is deprived of an adequate supply of arterial blood long enough for the tissue to die (necrosis).
   2. Discuss the symptoms.
      a. Pain and extreme fear
         (1) Pain is in same location as angina
         (2) Victim describes the pain as:
            (a) Constricting
            (b) Compressing
            (c) Aching
            (d) Crushing
         (3) Victim does not describe the pain as:
            (a) Sharp
            (b) Stabbing
            (c) Throbbing
         (4) Pain is intense.
         (5) Pain is longer than angina pain (an hour or longer).
         (6) Nitroglycerin has no effect.
         (7) If no pain, it is called silent AMI.
         (8) Pain may appear during rest.
         (9) AMI usually follows angina pain (i.e., angina pain is a warning).
      b. Respiratory—symptom is dyspnea (shortness of breath)
      c. Cerebral

NOTES

(1) Irritability
(2) Restlessness
(3) Inability to concentrate
(4) Perhaps mild delirium
(5) Perhaps mental depression
(6) Perhaps personality change
(7) Anxiety
(a) Light-headedness
(b) Hyperventilation

d. Gastrointestinal
(1) Loss of appetite (anorexia)
(2) Nausea
(3) Vomiting

e. Diaphoresis

3. Discuss the signs of AMI.
a. Signs vary (depends on the site and extent of damage and degree of autonomic nervous system).
b. Pulse
(1) Rate can be:
(a) Fast
(b) Slow
(c) Normal
(2) Rhythm (often irregular) skips beats
(3) Force (can be strong or weak)
c. Blood pressure varies—can be:
(1) Low
(2) Normal
(3) Elevated, in response to pain and fear

4. Discuss the treatment of uncomplicated AMI.
a. Point out that EMT must proceed to the victim with all possible speed, full sirens, and flashers (regard as an extreme emergency).
b. Point out that treatment begins immediately in any middle-aged or older patient with chest pain.
c. Point out that treatment starts before taking the history and physical examination.
d. Discuss the management of an uncomplicated AMI.
(1) Administer oxygen by mask or nasal cannula.
(2) Initiate intravenous lifeline D5W, using 250-

NOTES

milliliter bag and microdrop infusion set. *Do not* use saline; it can precipitate heart failure.

(3) Attach monitoring electrodes.

(4) Take blood pressure and repeat at least every 5 minutes.

(5) Take the pulse.

(6) Obtain orders to administer lidocaine.

(7) Have the following drugs available:

(a) Morphine sulfate (discuss exceptions and dose)

(b) Atropine sulfate (discuss dose)

(8) Obtain a history and conduct a physical examination.

(9) Transport patient after he is stable; exceptions:

(a) Cardiac arrest due to uncontrollable hemorrhage

(b) Cardiac arrest secondary to cold exposure

(c) Cardiac rhythms that require immediate pacemaker insertion

(10) Transport (semisitting position), *no* sirens to hospital; stop en route if cardiac arrest or arrhythmia occurs.

E. Congestive heart failure

1. Define it as mechanical pump failure that may follow AMI or chronic hypertension.
2. Discuss the two types.
   a. Left heart failure
   b. Right heart failure
3. Discuss left heart failure.
   a. Introduction
      (1) Left heart failure usually occurs first.
      (2) Damaged tissue makes the left ventricular wall adynamic (will not contract).
      (3) Blood is delivered to the left ventricle, but is not completely ejected.
      (4) Blood begins to back up.
      (5) Backed-up blood causes increased pressure in the ventricle, left atrium, and pulmonary vein.
      (6) Pulmonary veins become rigid.
      (7) Causes pulmonary congestion (backward heart failure).

NOTES

(8) Blood volume and pressure increase in the lungs.

(a) Serum is forced out of the capillaries into alveolar spaces.

(b) Serum then mixes with air and forms a foam (pulmonary edema).

(c) Pulmonary edema prevents the oxygenation of blood.

(d) Acidosis is the final result.

b. Signs and symptoms

(1) Weakness and fatigue

(2) Indigestion

(3) Cyanosis, when very severe

(4) Dyspnea; classic and primary symptom (discuss why it occurs); orthopnea

(5) Rapid breathing (tachypnea)

(6) Rales and dry, coarse rattling in throat (discuss why it occurs)

(7) Coughing and choking

(8) "Cardiac asthma"

(9) Bloodstained sputum (discuss why it occurs)

(10) Tachycardia

c. Treatment

(1) Administer oxygen (positive pressure, if available).

(2) Sit the patient up with the feet dangling (encourages venous pooling in the legs and makes it easier for the patient to breathe).

(3) Start intravenous (IV) lifeline with D5W to keep it open.

(4) Attach monitoring electrodes.

(5) Have the following medications ready (discuss dosages and route of administration):

(a) Morphine sulfate

(b) Aminophylline

(c) Furosemide (Lasix)

(d) Digoxin

(6) Take vital signs.

4. Discuss right heart failure.

a. Introduction

NOTES

(1) Right heart failure is caused primarily by left heart failure.
(2) Pressure in pulmonary vascular system causes right heart to work faster to overcome pressure.
(3) Ventricle will fail because it cannot keep up the pace.
(4) When the ventricle fails:
(a) Blood backs up into the vein
(b) Backup increases the venous pressure
(c) Blood serum escapes into the tissue and produces edema

b. Signs and symptoms
(1) Tachycardia
(2) Venous congestion
(a) Organ engorgement
(i) Liver
(ii) Spleen
(iii) Kidney
(b) Vein distention
(i) Jugular
(ii) Superficial veins
(3) Peripheral edema (pitting edema)
(a) Lower extremities
(b) Entire body (anasarca)
(4) Accumulation of fluid into serous cavities
(a) Abdominal cavity (abdominal distention—ascites)
(b) Pleura
(c) Pericardium

c. Treatment and management
(1) Have the patient sit up.
(2) Administer oxygen.
(3) Monitor the patient.
(4) Treat for left heart failure.
(5) Take vital signs.

F. Ventricular aneurysm
1. Define it as a thin-walled bulge in the area of the necrotic tissue (usually in the wall of the left ventricle).
2. Point out that if the bulge covers one-quarter of the left ventricle, it will cause congestive heart failure.

NOTES

G. Cardiac rupture
   1. It is exceedingly uncommon.
   2. It usually occurs at the area of the necrotic tissue.
   3. It usually occurs at the wall of the left ventricle or:
      a. In the papillary muscle
      b. In the interventricular septum
   4. When a rupture occurs:
      a. Blood escapes into the pericardial sac and distends it.
      b. This distention interferes with the normal filling and emptying of the heart (pericardial tamponade).
      c. In the case of papillary muscle rupture, acute valvular dysfunction can result.
   5. Signs and symptoms
      a. Dyspnea
      b. Slow heart rate
      c. Shock (usually)
   6. Death could occur within minutes.

H. Cardiogenic shock
   1. Cause: heart is so damaged that it can no longer pump an adequate volume at an adequate pressure.
   2. Signs and symptoms
      a. Confused or comatose
      b. Apprehension
      c. Skin is cold and clammy
      d. Respirations are rapid and shallow
      e. Pulse is racing and thready
      f. Decrease in blood pressure
   3. Treatment
      a. Secure an open airway and administer oxygen; if patient is comatose, endotracheal intubation will be necessary.
      b. Place the patient in a supine position.
      c. Start an IV, D5W.
      d. Apply monitoring electrodes.
      e. Have the following drugs ready (discuss the dosage and route):
         (1) Norepinephrine (Levophed) or dopamine (Intropin)
         (2) Sodium bicarbonate
         (3) Methylprednisolone (Medrol)

NOTES

f. Take vital signs.

I. Syncope (fainting)

1. Define it as a sudden, temporary loss of consciousness.
2. Causes
   a. Cerebral hypoxia is secondary to inadequate cerebral blood flow
   b. Cardiac problems
3. Types
   a. Simple syncope (vasovagal)
      (1) It is precipitated by some stress that induces dilatation of blood vessels and consequent pooling of blood in the extremities.
      (2) It can occur when someone is either sitting or standing.
      (3) Patient regains consciousness quickly in a horizontal position.
   b. Syncope of cardiac origin—occurs in any position
   c. Postural syncope
      (1) It occurs when a patient sits or stands from a supine position.
      (2) Its causes include drugs, chronic diseases, and prolonged standing in hot weather.
   d. Vagal causes of syncope-sensitive carotid sinus, vagal discharge, and violent coughing, laughing, or urination
4. History information
   a. In what position was the patient when the faint occurred?
   b. Were there any premonitory symptoms?
   c. Did some stressful event precede the faint?
   d. Has the patient ever fainted before, and under what circumstances?
   e. Does the patient have history of cardiac disease?
   f. Is the patient taking any medication?
5. Treatment (from any cause)
   a. Place the patient in a supine position, where he has fallen—keep him flat.
   b. Establish an airway and administer oxygen.
   c. Loosen any tight clothing on the patient.
   d. Lift the patient's lower extremities for 10–20 seconds to facilitate venous return to the heart.

NOTES

e. Apply monitoring electrodes.
f. Take vital signs.

J. Myocardial trauma
   1. Causes
      a. Point out that the main cause is automobile accidents.
      b. Point out that while at the scene, the EMT must look for signs of frontal impacts.
   2. Complications
      a. Myocardial contusions—behave like AMI
         (1) Right-side injury usually results in atrial arrhythmias and heart block.
         (2) Left side is more prone to ventricular arrhythmias.
      b. Cardiac tamponade
         (1) Blood is in the pericardial sac.
         (2) Surrounding fluid causes strain on the heart.
         (3) Arterial pressure falls because of reduced cardiac output.
         (4) Venous pressure rises (neck vein distention).
         (5) Heart sounds distant upon auscultation.
         (6) Pulse pressure declines.
         (7) Cardiac tamponade is considered a dire emergency (move the patient to the hospital after doing everything you can in the field).

K. Hypertension (high blood pressure)
   1. Contributing cause of AMI
   2. Definition: when blood pressure is greater than 165/95
   3. Acute hypertensive crisis
      a. Sudden rise in blood pressure to greater than 200/130
      b. Treatment
         (1) Secure an airway and administer oxygen.
         (2) Start an IV, D5W.
         (3) Apply electrodes and monitor.
         (4) Transport rapidly to the hospital.
         (5) Take vital signs.

L. Cardiac arrest
   1. Define it as a cessation of pumping action.
   2. Point out that it occurs with ventricular fibrillation, cardiac standstill, or severe shock.

NOTES

3. Discuss vital signs.
   a. Pulse—absent immediately after arrest
   b. Respiration—absent within 15 to 20 seconds
   c. Blood pressure—absent immediately after arrest
4. Discuss the skin.
   a. Pale and cyanotic
   b. Cold and clammy
5. Discuss unconsciousness.
6. Discuss the eyes.
   a. Drooping eyelids
   b. Vacant dull stare
   c. Dilation of pupils—starts within 30 seconds and becomes completely dilated within 1½ to 2 minutes (dilation may also be due to drugs, prescribed medications, or other conditions).
7. Treatment of CPR

NOTES

Summary

- Coronary artery disease
- Angina
  - — Stable
  - — Unstable
- AMI
  - — Causes
  - — Signs and symptoms
  - — Treatments
- Congestive heart failure (left and right)
  - — Causes
  - — Signs and symptoms
  - — Treatment
- Ventricular aneurysm
- Cardiac rupture
- Cardiogenic shock

- — Causes
- — Signs and symptoms
- — Treatment

- Syncope

  - — Causes
  - — Signs and symptoms
  - — Treatment

- Myocardial trauma
- Acute hypertensive crisis

NOTES

UNIT 4 emt-p

READING AND UNDERSTANDING A NORMAL EKG

NOTES

Knowledge Objectives

After completing this module, the student should be able to correctly respond to at least 80 percent* of the following:

4.1.1.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that describes how an EKG record is produced.

4.1.2.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that best describes what an ectopic focus is.

4.1.3.K Given a list of definitions, the student should be able to correctly select the definitions of:

- Depolarization
- Repolarization

4.1.4.K Given a list of statements, the student should be able to select the statement(s) that best describes how the electrical impulse passes through the electrical conduction system (i.e., the order in which the electrical impulse passes through the structures of the electrical conduction system).

*The selection of 80 percent as a passing criterion is arbitrary and can be modified.

NOTES

4.1.5.K Given a list of statements, the student should be able to select the statement(s) that best describes what an EKG record shows (electrical activity vs. mechanical activity).

4.2.1.K Given a normal sinus rhythm EKG record and the following labels:

- P wave
- QRS complex
- T wave
- P-R interval
- R-R interval
- Isoelectric line
- S-T segment

the student should be able to correctly attach the labels to the EKG record.

4.2.2.K Given several lists of time intervals, the student should be able to select the normal time intervals associated with:

- QRS complex
- P-R interval

4.2.3.K Given the following list of items:

- P wave
- QRS complex
- T wave

the student should be able to correctly match them to:

- Atrial depolarization
- Ventricular depolarization
- Ventricular repolarization

4.3.1.K Given at least three EKG records, the student should be able to correctly calculate the rate of the heartbeat using any of the following techniques:

- Calculator ruler

- Six-second count
- Triplicate method

4.3.2.K Given a list of at least four definitions, the student should be able to correctly identify the definitions of:

- Rate
- Rhythm

Instructor Activities

Assign the material referred to below during the class period immediately before beginning the unit:

- Chapter 6, Unit 4, of the *Text*
- Knowledge objectives for this unit

Prepare a lecture following the content outline on page VI-58. The following suggestions are made:

- Inform the students that it is necessary to fully understand a normal EKG before they can examine abnormal EKG's; when abnormal EKG's are examined, they are compared to normal ones.
- Stress the normal time intervals throughout the lecture.
- Stress the meaning of each wave, complex, segment, and interval. The student must have a basic understanding of what is going on in the normal heart before he can tell what is going wrong in an abnormal one.
- When appropriate, hand out EKG paper and a normal sinus rhythm to every student.

Equipment and Materials

Equipment—Educational

Chalkboard and chalk

Equipment—Medical

None

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Materials

EKG paper (sample for every student)
Calculator ruler (one for every student)
Normal EKG record (one for every student)
Knowledge objectives (optional)
Text

NOTES

Content Outline

Introduction

- Inform the students there are no:
  - — Demonstrations
  - — Practice exercises
- Explain the purposes of the unit.
  - — To review the electrical conduction system and how the electrical impulse travels
  - — To understand how to read and understand a normal EKG, so that later there will be an understanding of abnormal EKG's
  - — To learn to read an EKG paper

4.1. Introduction (review)

A. Muscle contraction
1. Each cell of the heart is capable of contracting by itself (independently and automatically, without an electrical stimulus).
2. As a single cell begins to contract, it will influence the contraction of the adjacent cells.
3. Not all cells will contract at the same rate and rhythm.
4. Some cells fire at a faster rate than others.
   a. SA node fires 60 to 100 times per minute.
   b. AV node fires 45 to 55 times per minute.
   c. Purkinje system fires 30 to 40 times per minute.
   d. Any part can be the pacemaker.
5. The dominant pacemaker is located in the SA node.

NOTES

a. Located at right atrium entrance to the superior vena cava.
b. It is a pacemaker because it fires at the fastest spontaneous rhythm.

6. From the SA node, an excitation wave spreads through the muscles of the atrium and causes it to contract.
7. Muscles of the atria are not connected to the muscles of the ventricle.
   a. The contracting atria muscles will not stimulate the ventricular muscles to contract.
   b. From the SA node, there are internodal atrial pathways that send impulses to the AV junction.
8. From the AV junction, impulses reach the AV node.
   a. AV node is located in the lower part of the interatrial septum in front of the coronary sinus.
   b. Impulse travels from the SA node to the AV node in 0.08 second.
   c. AV node sends impulses to the ventricle so it can contract.
9. Impulses travel through the AV node relatively slowly, between 0.08 and 0.16 second.
10. From the AV node, impulses travel through:
    a. Bundle of His
    b. Right and left bundles
    c. Purkinje fibers
    d. Purkinje network
11. Sometimes the following occurs:
    a. Impulse travels through the bundle branch in 0.03 to 0.05 second.
    b. It may take 0.10 second for impulses to travel from the AV node to the terminal of the Purkinje fibers.
12. The Purkinje system carries the impulse so the ventricular muscles can contract.
    a. Impulses travel first through the Purkinje system to the papillary muscles so the atrioventricular valves can close (first).
    b. Then, the rest of the ventricle contracts.

B. Polarization, depolarization, and repolarization
   1. Heart cells are charged or polarized in a resting state.
   2. The process in which cells are stimulated to contract is called depolarization.

3. The process in which cells are recharged to be capable of stimulation is called repolarization.
4. Depolarization and repolarization activities can be characterized as follows:
   a. Discuss single fiber activity.
      (1) Discuss the resting polarized state.
         (a) Outside of the fiber has a positive charge.
         (b) Inside of the fiber has a negative charge.
      (2) Discuss electrical stimulus applied to one end of the fiber—the charges begin to reverse.
         (a) The outside becomes negative.
         (b) The inside becomes positive.
      (3) Point out that once the interior is positive, it spreads through the rest of the fiber as a wave.
      (4) Point out that after a positive wave travels through the fiber, it contracts.
      (5) Point out that following contraction:
         (a) A negatively charged wave spreads through the fiber.
         (b) This phenomenon is repolarization.
         (c) The wave moves in the opposite direction of the depolarization wave.
      (6) Point out that the fiber is now at a polarized state, ready to be stimulated again.
   b. Point out that during repolarization, the fiber cannot respond to stimulation—this is called the absolute refactory period (ARP).
   c. Follow ARP as repolarization nears completion, the fiber can be stimulated to contract prematurely—this is called the relative refractory period (RRP).
   d. Point out that the depolarization and repolarization activities of the atria and ventricles constitute electrical energy.
      (1) This phenomenon can be sensed on the surface of the body by skin electrodes.
      (2) If amplified, the impulse can be recorded.
      (3) This record is called an electrocardiogram (EKG).

NOTES

4.2. An EKG record (Provide an illustration of an EKG record and components.)

NOTES

A. P wave
   1. SA node fires, sending an electrical impulse stimulating both atria (normal pacemaker).
   2. This stimulation yields a P wave (0.10 second in duration).
   3. P wave represents the electrical activity associated with atrial depolarization.
   4. Impulses reach the AV node, where there is a 0.08-second pause allowing blood to enter the ventricles.
   5. Atrioventricular valves are open during atrial contraction (depolarization).

B. QRS complex
   1. After a 0.10-second pause, the AV node is stimulated.
   2. This initiates an electrical impulse that starts down the AV bundle into the bundle branches.
   3. QRS complex represents the electrical impulse as it travels from the AV node to the Purkinje fibers and into the myocardial cells.
   4. QRS complex represents ventricular depolarization.

C. S-T segment and T wave
   1. Point out that there is a pause after the QRS complex.
   2. Point out that the pause is followed by a T wave.
   3. Point out that the T wave represents the repolarization of ventricles so they can be stimulated again.
   4. Point out that there is no mechanical activity during the T wave, only electrical.

D. Summary
   1. P wave = atrial depolarization
   2. QRS complex = ventricular depolarization
   3. T wave = ventricular repolarization
   4. P-QRS-T sequence represents one complete cardiac cycle.
   5. Repolarization of the atria is not represented.
      a. Atrial T wave represents atria repolarization (follows a P wave)
      b. Atrial T wave normally is not visible on an EKG
      c. Atrial T wave is buried in the QRS complex

6. During the repolarization of atria and ventricles, no mechanical activity occurs—only electrical activity.

E. Segments and intervals
   1. Point out that a segment includes no waves.
   2. Point out that an interval is between waves.
   3. Discuss the S-T segment.
      a. Define it as the time between ventricular depolarization and repolarization.
      b. Point out that it includes no waves.
   4. P-R interval
      a. Define it as time between the onset of the P wave produced by atrial depolarization and the onset of the QRS complex produced by ventricular depolarization.
      b. Point out that it includes waves.
   5. R-R interval
      a. Define it as the period between the beginning of one QRS complex and the subsequent QRS complex.
      b. Point out that it includes waves.

F. Relationship between the EKG and blood pressure
   1. EKG is electrical.
   2. However, in a normal heart, electrical impulses are associated with mechanical functions; in a diseased heart, there may be complexes without associated effective mechanical activity.
   3. During atrial depolarization the following occurs:
      a. Atrium contracts
      b. AV valve opens
   4. During ventricular depolarization, the following occurs:
      a. Ventricles contract
      b. AV valves close
      c. Semilunar valves open
   5. EKG can also be related to the cardiac cycle.
      a. QRS complex coincides with the ventricular systole
      b. S-QRS coincides with the ventricular diastole

4.3. EKG paper (Provide a sample.)

A. Ruled paper
   1. Small divisions—1 millimeter square

NOTES

a. Height and depth of waves represent a measure of voltage (in millimeters).
b. Upward deflections are positive.
c. Downward deflections are negative.

2. Horizontal axis (assume 25 millimeters per second)
a. This axis represents time.
b. Each little line represents 0.04 second.
c. A block of five represents 0.2 second.

B. Paper
1. Has a grid
2. Is usually on rolls

4.4. Reading an EKG (basic)

A. Point out that in reading an EKG, one must look at:
1. Rate
2. Rhythm
3. P waves (including P-R interval)
4. QRS complexes

B. Discuss the rate.
1. Define it as the number of cycles per minute or the number of ventricular complexes that occur in one minute.
2. Recall:
a. The SA node fires 60 to 100 times per minute and sets the heart rate.
b. If the pacemaker fails, other areas have the ability to be the pacemaker.
(1) Secondary pacemakers
(2) Ectopic focus
3. Discuss ectopic pacemakers.
a. Atria rate is about 75/min
b. AV node rate is about 60/min
c. Ventriclar rate is about 30–40/min
4. Discuss the methods of determining the rate.
a. Discuss the calculator ruler.
(1) Point out that there are many kinds.
(2) Point out that it is a special device.
b. Point out that without special devices:
(1) A 6-second count is the most accurate.
(2) Triplicates method is only useful if the rhythm is regular.

NOTES

5. Discuss the 6-second count.
    a. Point out that at the top of an EKG tracing are vertical marks that denote 3-second intervals.
    b. Point out that two of these intervals represent 6 seconds.
    c. Tell the students to count the number of QRS complexes within the 6-second strip.
    d. Tell the students to multiply the count by 10 to get the rate per minute.
    e. Point out that the determined rate is slower than the actual heart rate.
6. Discuss the triplicates method.
    a. Have the students find the R wave that falls on the heavy black line.
    b. Tell them to count off 300, 150, and 100 for each heavy black line.
    c. Tell them to count the next three heavy black lines as 75, 60, and 50.
    d. Point out that where the next R interval falls is the rate.
7. Point out that the normal rate is 60 to 100/min.

C. Discuss rhythm.
1. Point out that rhythm is determined by comparing the duration between QRS complexes.
2. Point out that if the distance is equal, the rhythm is regular.
3. Point out that if the distance varies, the rhythm is irregular.
4. Point out the need to check the R-R intervals.

D. Discuss P waves.
1. Tell the students to ask themselves the following questions:
    a. Are P waves present or absent?
    b. Is there a P wave before every QRS complex?
    c. Is there a QRS after every P wave?
    d. Are the P waves similar in shape and size?
    e. What is the duration of the P-R interval? Is it normal or longer than normal?

E. Discuss the QRS complex.
1. Instruct the students to ask themselves the following questions:

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a. Are QRS complexes present or absent?
b. Do they follow P waves?
c. Do the P waves and the QRS complexes have a definite relationship? Do they occur together, or are they independent of one another?

NOTES

UNIT 5

ARRHYTHMIA RECOGNITION

Knowledge Objectives

NOTES

After completing this module, the student should be able to correctly respond to at least 80 percent* of the following:

5.1.1.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that describes the potential causes of an arrhythmia.

5.2.2.K Given a list of at least four statements, the student should be able to correctly identify the statement(s) that describes the meaning of:

- Distorted P wave
- Irregular R-R interval
- P-R interval that is greater than 0.20 second
- P-R interval that is less than 0.12 second
- A wide QRS complex
- An elevated S-T segment

5.2.3.K Given any of the following rhythms on a 6-second EKG record:

- Normal sinus rhythm
- Sinus arrhythmia

*The selection of 80 percent as a passing criterion is arbitrary and can be modified.

- Sinus bradycardia
- Sinus tachycardia
- Sinus arrest
- Premature atrial contraction
- Supraventricular tachycardia
- Atrial flutter
- Atrial fibrillation
- First-degree block
- Second-degree block
- Third-degree block
- Premature ventricular contraction
- Ventricular tachycardia
- Ventricular fibrillation
- Asystole
- Pacemaker rhythm

the student should be able to correctly:

- Determine if the rhythm is regular, irregular, or occasionally irregular
- Determine if P waves are present or absent
- Determine if P waves are positive or negative
- Determine if the P waves are normal or abnormal in size or shape
- Determine if the sequence of P-QRS-T is normal or abnormal
- Determine if the P-R interval is present or absent
- Determine the duration of the P-R interval
- Determine if the QRS complex is normal or abnormal
- Determine the location of the pacemaker
- Determine the name of the arrhythmia
- Identify from a list of at least four statements the one(s) that best describes what is happening in the heart

Instructor Activities

Assign the knowledge objectives for this unit during the class period immediately before beginning the unit.

Inform the students there will be a practical exercise on recognizing certain characteristics of certain arrhythmias.

NOTES

Prepare a lecture following the content outline on page VI-71. The following suggestions are made:

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- Before starting this lecture, the following points should be made to the students:

  — Reading and understanding arrhythmias is a complex behavior. The first thing you, as a student, have to know is what a normal sinus rhythm looks like and how the electrical conduction system works to produce a normal sinus rhythm.
  — It is necessary to recognize the abnormal characteristics of any EKG record (i.e., to recognize that characteristic—e.g., a P wave, a QRS complex, P-R interval—as being abnormal).
  — Once a characteristic (a wave, complex, or interval) is recognized as being abnormal, it is necessary to think about what in the electrical conduction system is happening to cause the abnormality shown on the EKG.
  — The last step in the behavior is to associate the abnormality and electrical event to a label (the name of the arrhythmia). Usually, the name is similar to what is happening in the electrical conduction system. For example, if the P-R interval is extended, you must ask yourself what is happening electrically. The answer to this question will help you to determine the name of the arrhythmia.
  — The naming of the arrhythmias will come only after you, as a student, can recognize the abnormality and associate the abnormality with the electrical activity.

  Thus, the student's job is to become familiar with recognizing abnormal characteristics.

- When Section 5.2 of the content outline is discussed, notice that it is primarily designed to review the characteristics of a normal EKG and to point out what abnormalities might happen. When a given abnormality is discussed, such as prolonged P-R intervals, the instructor should display a strip where there are prolonged intervals (at this point, the name of the arrhythmia need not concern the students, the point is to recognize the prolonged interval). In addition, it might be helpful to discuss

what is happening electrically to the heart to produce the abnormality. If the students begin to understand what is happening, they are on their way to learning the names of the arrhythmias.

- In the last part of Section 5.2, it is suggested that the students be exposed to 14 arrhythmias. It is strongly suggested that this be accomplished with a set of slides or actual EKG records (one for every student). As an instructor, you should try to present the arrhythmias in the order that they appear in the outline. Notice this order moves down the electrical conduction system in a logical fashion. When each slide is shown, ask the students to determine such things as the rate and rhythm and if P waves are present or absent. When an abnormality is noted, ask the students to explain what is happening in the electrical conduction system. As a final comment, give the students the name of the arrhythmia. At this point, do not discuss the treatment of the arrhythmias.
- After the completion of the lecture, have the students do the practical exercise. (See the description of the practical exercise.)

Prepare a written test using the specified knowledge objectives. Test the students after they have had time to study the material.

Equipment and Materials

Equipment—Educational

Chalkboard and chalk
Slide projector and screen

Equipment—Medical

Actual EKG records

Materials

Knowledge objectives (optional)
Knowledge test (to be prepared by the instructor)
Text (Ch. 6)
Practical exercise forms (to be prepared by the instructor)

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Suggested Material

Slides of EKG records

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Content Outline

Introduction

- Explain the purposes of this unit.
  - — To discuss the potential causes of arrhythmias
  - — To discuss how abnormal EKG's differ from normal sinus rhythm
  - — To discuss the major characteristics of 14 arrhythmias (Note: Treatment of the arrhythmias will be discussed in a later unit.)
  - — To be able to recognize 14 arrhythmias
- Read the knowledge objectives.
- Inform the students that there will be a practical exercise.

5.1. Introduction to arrhythmias

A. Definition: disturbances in rate, rhythm, or conduction
B. Causes
   1. Direct damage to a portion of the electrical conduction system because of:
      a. Necrosis
      b. Ischemia
   2. Imbalance of the activity in the autonomic nervous system because of:
      a. Catecholamines
      b. Increased sympathetic tone
      c. Increased parasympathetic tone
   3. Distention of the heart chambers and stretching of the heart walls
      a. Point out that this occurs especially in the atria.
      b. Point out that it occurs because of congestive heart failure.

4. Blood gas abnormalities
   a. Discuss low blood oxygen (hypoxemia).
   b. Discuss elevated blood carbon dioxide (hypercarbia).
   c. Discuss changes in blood pH such as acidosis or alkalosis.
   d. Point out that abnormalities occur because of pulmonary congestion and edema.
5. Release of toxic substances from damaged tissue can affect the electrical conduction system. These substances are:
   a. Potassium (excess)
   b. Magnesium (excess)
   c. Lactic acid
   d. Adenosine
   e. Amino acids
   f. Enzymes
6. Electrical instability because of differences in electrical potential between damaged and normal tissue.
7. Irritation or inflammation of electrical conduction system because of pericarditis (inflammation of the pericardium).

C. Other causes
1. Overdose of cardiac drugs, such as:
   a. Digitalis
   b. Procainamide
   c. Quinidine
   d. Atropine
   e. Lidocaine
   f. Epinephrine
   g. Isoproterenol
2. Increased or decreased serum potassium (hyperkalemia and hypokalemia)
3. Increased or decreased serum calcium (hypercalcemia and hypocalcemia)

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5.2. Introduction to reading arrhythmias

A. Normal EKG record
1. Rate

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a. Normal (60–100/min) (Display a normal record and have the students calculate the rate.)
b. Abnormal
   (1) Point out that the level is less than 60/min.
   (2) Point out that the level is greater than 100/min.
   (3) Discuss dangerous levels (Display very slow and very fast records.)
      (a) 50/min or less
      (b) 120/min or more

2. Rhythm
   a. Point out that it is determined by the R-R interval.
   b. Point out that normal (regular) rhythm is generally defined as having equal distance between QRS complexes.
   c. Discuss abnormal (irregular) rhythm.
      (1) Define it as unequal distance between QRS complexes.
      (2) Discuss the two kinds of irregular rhythm.
         (a) Constantly irregular—every R-R interval is unequal (show an example)
         (b) Occasionally irregular—only one or two R-R intervals are unequal, the rest are equal (show an example)

3. P waves, QRS complexes, and intervals
   a. P waves (normal)
      (1) Point out that they are present.
      (2) Discuss positive deflection.
      (3) Discuss the smooth, round shape.
      (4) Point out that all normal P waves look exactly the same.
      (5) Discuss the sequence; each P wave appears before each QRS complex.
   b. P waves (abnormal) (show examples)
      (1) Can be absent
      (2) Can be present, but:
         (a) Deflection can be either positive or negative.
         (b) The shape can be abnormal (flat or peaked).
         (c) All the P waves may not look the same (some flat, some peaked, some positive, some negative).

(d) Some P waves may come before, after, or during QRS complexes.

c. P-R interval (normal)
   (1) Normal P-R interval is present and measurable.
   (2) Normal P-R interval is between 0.12 and 0.20 second.
   (3) The distance is constant for each patient.

d. P-R interval (abnormal) (show examples)
   (1) P-R interval is absent if P waves are absent.
   (2) P-R interval can be absent or nonmeasurable.
   (3) Size of the waves is abnormal if greater than 0.20 second or less than 0.12 second.
   (4) P-R interval is abnormal if the distance is short or extended but varying.

e. QRS complexes (normal) (show examples)
   (1) About 0.10 to 0.11 second long
   (2) All the same shape and size

f. QRS complexes (abnormal) (show examples)
   (1) Greater than 0.12 second in length
   (2) Bizarre in shape

B. Abnormal EKG records

1. Point out that the primary objective is to find out what is going on in the heart (i.e., to relate complexes to electrical events).
2. Discuss suggested steps to recognize an abnormal EKG.
   a. Locate R waves
   b. Locate 6-second strip and compute the rate; determine if the rate is:
      (1) Normal
      (2) Fast (greater than 100/min)
      (3) Slow (less than 60/min)
   c. Locate several P-R intervals in sequence; determine if the intervals are:
      (1) Regular
      (2) Constantly irregular
      (3) Occasionally irregular
   d. Locate and examine several P waves.
      (1) Determine whether they are present or absent.
      (2) Determine whether they are positive or negative.

NOTES

(3) Determine whether they vary between positive and negative.

(4) Determine whether they are normal in size and shape.

(5) Determine whether shape and size are constant or if shape and size vary.

(6) Determine whether P waves are before each QRS complex or if they:

(a) Are after each QRS complex

(b) Are during each QRS complex

(c) Are before most QRS complexes

(d) Have no relationship to QRS complexes

e. Locate and examine P-R intervals; determine whether they are present or absent and:

(1) Measure the length of the interval

(2) Determine if the length is normal, greater than 0.20 second, or less than 0.12 second

(3) Determine if the P-R intervals are constant or vary

f. Locate and examine the QRS complexes.

(1) Are they normal?

(2) Are they wide?

(3) Are they bizarre?

g. Determine the location of the pacemaker.

3. Discuss interpretations.

a. Point out that an unequal R-R interval means the rhythm is irregular (If the rhythm is occasionally irregular, think of it as a premature beat).

b. Point out that if P waves are negative, there is an ectopic focus in the AV junction.

(1) This focus is usually accompanied by a shortened P-R interval.

(2) P waves are usually present before each QRS complex.

c. Point out that if P waves are absent:

(1) Atrial fibrillation is implied.

(2) Atrial flutter may appear as absent P waves in some cases.

(3) Remember that it may mean there is an ectopic site in the atria.

d. Point out that if P waves are present but abnormal

NOTES

and before each QRS complex, it means there is an ectopic site in the atria.

e. Point out that if there are wide QRS complexes, there is an ectopic site in the ventricles or there is an abnormality of the ventricular conduction system.

4. Discuss examples of arrhythmias.
   a. Show the following arrhythmias and explain their main characteristics (using the form in practice session 1):
      (1) Normal sinus rhythm
      (2) Sinus arrhythmia
      (3) Sinus bradycardia
      (4) Sinus tachycardia
      (5) Sinus arrest
      (6) Premature atrial contraction
      (7) Supraventricular tachycardia
      (8) Atrial flutter
      (9) Atrial fibrillation
      (10) First-degree block
      (11) Second-degree block
      (12) Third-degree block
      (13) Premature ventricular contractions
      (14) Ventricular fibrillation
      (15) Ventricular tachycardia
      (16) Asystole
      (17) Pacemaker
5. Present Practice Session 1.

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Practice Session 1

NOTES

Purpose

This exercise is designed as a workbook learning experience, where the students have an opportunity to recognize abnormalities in EKG records and begin to associate the name of the arrhythmia to certain sets of characteristics.

Preparation

This exercise is based on the use of arrhythmia recognition forms; a sample form is included on pages VI-79 to VI-80. To prepare the arrhythmia recognition forms, the instructor should begin to collect actual arrhythmias when the course begins. It is suggested that the instructor collect at least four different EKG records for each type of arrthythmia. To prepare the forms, all the instructor need do is place the actual EKG record in the space provided on the form and duplicate the forms for the students. Each form prepared should have an identification number. For each form, the instructor should prepare a master key, with which the students can check their own answers.

Procedure

Complete the forms and place them in a workbook format. Have students progress through the workbook at their own pace (during class time as well as out of class). To make the exercise more meaningful, the instructor should ask the students to compare certain EKG records; for example, two arrhythmias that are the same but look different, two different arrhythmias that are close to each other and might be easily confused.

These exercise sheets can be used in a variety of ways. First, students can use the sheets to sharpen their ability to detect the important characteristics of an EKG record. If the sheets are being used for this purpose, the students need not be concerned with trying to identify the arrhythmia by name. Second, the sheets can be used to strengthen the association between an arrhythmia with certain characteristics and the arrhythmia name. If the exercise sheets are being used for this purpose, students may find it helpful to complete the exercises in a specific order; for example, the students could:

- Determine the characteristics of normal sinus rhythm (A).
- Determine the characteristics of sinus arrhythmia (B).
- Compare the characteristics of A and B (C).
- Determine the characteristics of sinus bradycardia (D).
- Compare the results of A and D (E).
- Determine the characteristics of sinus tachycardia (F).
- Compare F with D and A.

This type of approach will help the student distinguish the characteristics of EKG records that are similar yet decidedly different. Third, the exercise sheets can be used to help the student learn the treatments for specific arrhythmias. Since the lecture given before these exercise sheets does not cover drug treatment, it is strongly recommended that students not be required to complete this segment of the exercise sheets at this time. Immediately following the lecture on drugs, however, the students should complete their exercise sheets.

NOTES

Student's name _____

Identification number _____

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Directions: Please examine the above EKG record and answer the questions below.

Section A

1. R waves are
   ____ a. Present
   ____ b. Absent

2. Compute the rate and record it in the space below
   ____ Beats per minute

3. Which of the following best describes the R-R intervals?
   ____ a. Regular (or slightly irregular)
   ____ b. Constant irregular
   ____ c. Occasional irregular, for example, premature beats

   NOTE: If you selected Response c, go to Section E, Question 13. If you selected Response a or b, go to Section B, Question 4.

Section B

4. P waves are
   ____ a. Present
   ____ b. Absent (Go to Section C, Question 10.)

5. In general, are the P waves positive or negative?
   ____ a. Positive
   ____ b. Negative
   ____ c. Vary from positive to negative

6. In general, which of the following best describes the size and shape of P waves?
   ____ a. Normal (or relatively normal)
   ____ b. Abnormal
   ____ c. The size and shape vary from normal to abnormal

7. Which of the following best describes the location of the P wave with respect to the QRS complex?

   In general,
   ____ a. There is a P wave before each QRS complex.
   ____ b. The P waves tend to follow the QRS complexes.
   ____ c. There are QRS complexes after only some P waves.
   ____ d. There is no relationship between the P waves and QRS complexes.

8. Are P-R intervals present or absent?
   ____ a. Present
   ____ b. Absent

9. In general, which of the following best describes the site of the P-R interval?
   ____ a. Normal between 0.12 and 0.20 second

_____ b. Less than 0.12 second
_____ c. Greater than 0.20 second
_____ d. Varies

Go to Section D, Question 12.

Section C

10. Are F waves present or absent?
_____ a. Present
_____ b. Absent

11. Are f waves present or absent?
_____ a. Present
_____ b. Absent

Go to Section D, Question 12.

Section D

12. Which of the following best describes the QRS complexes?
_____ a. Normal
_____ b. Wide and bizarre

Go to Section F.

Section E

NOTE: Carefully examine the irregular beat(s) and answer the following questions for the irregular beats only:

13. Which of the following best describes the QRS complex for the irregular beat only?
_____ a. Normal
_____ b. Wide and bizarre

14. For the irregular beat, are P waves absent or present?
_____ a. Present
_____ b. Absent

Go to section B and complete it for the other beats.

Section F

Where do you think the location of the pacemaker is? (Remember it is possible that two or more pacemakers can exist.)
_____ a. SA node
_____ b. AV node
_____ c. Ectopic focus in the atria
_____ d. Ectopic focus in the ventricles
_____ e. Ectopic focus appears to vary
_____ f. External pacemaker

What do you think the name of this arrhythmia is? Print your answer in the space below.

NOTES

UNIT 6 emt-p

TECHNIQUES OF MANAGEMENT

NOTES

Knowledge Objectives

After completing this module, the student should be able to correctly respond to at least 80 percent* of the following:

6.1.1.K Given at least three lists, each containing at least four drugs, the student should be able to identify the drugs that:

- Increase or decrease automaticity
- Increase or decrease conductivity
- Decrease excitability

The list of drugs will contain, but not be limited to:

- Atropine
- Isoproterenol
- Lidocaine
- Procainamide and quinidine
- Propranolol
- Digoxin

6.2.1.K Given four lists, each consisting of at least four drugs, the student should be able to identify the drugs that produce the following side effects:

*The selection of 80 percent as a passing criterion is arbitrary and can be modified.

- Dryness of mouth, blurred vision, constipation, headaches
- Numbness, drowsiness, convulsions, mild deafness
- Bradycardia, hypotension and shock, pulmonary congestion, bronchial wheezing
- Sinus arrhythmia, ventricular tachycardia, loss of appetite, vomiting

6.2.2.K Given two lists, each containing at least four contraindications, the student should be able to identify the contraindication of the following drugs:

- Lidocaine
- Propranolol

6.2.3.K Given seven lists, each containing at least four statements, the student should be able to identify the statements that describe the proper dosage and method of administration of the following drugs:

- Atropine
- Isoproterenol
- Lidocaine
- Procainamide
- Quinidine
- Propranolol
- Digoxin

under given conditions.

6.2.4.K Given a list of at least four drugs, the student should be able to identify the drug(s) that increases or decreases systemic blood pressure.

6.2.5.K Given eight lists, each containing at least four statements, the student should be able to identify the statements that describe the general use of the following drugs:

- Sodium bicarbonate
- Epinephrine
- Calcium chloride

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- Aramine
- A vasopressor (i.e., dopamine)
- Morphine sulfate
- Diazepam
- A diuretic (i.e., Lasix)
- Coumadin
- Heparin

6.2.6.K Given any of the following drugs and a list of dosages, the student should be able to identify the proper dosage:

- Sodium bicarbonate
- Epinephrine
- Calcium chloride
- Aramine
- A vasopressor (i.e., dopamine)
- Morphine sulfate
- Diazepam
- A diuretic (i.e., Lasix)
- Coumadin
- Heparin

6.2.7.K Given at least four lists, each containing at least four conditions, the student should be able to identify the contraindications of the following drugs:

- Aramine
- A vasopressor (i.e., dopamine)
- Diazepam
- A diuretic (i.e., Lasix)

6.2.8.K Given at least five lists, each containing at least four side effects, the student should be able to identify the side effects of the following drugs:

- Sodium bicarbonate
- A vasopressor (i.e., dopamine)
- Morphine sulfate
- Diazepam
- A diuretic (i.e., Lasix)

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6.2.9.K Given at least five lists, each containing at least four contraindications, the student should be able to identify the contraindications for the following drugs:

- Sodium bicarbonate
- Calcium chloride
- Aramine
- A vasopressor (i.e., dopamine)
- Diazepam
- A diuretic (i.e., Lasix)

6.2.10.K Given a list of at least four drugs, the student should be able to identify the drugs that are vasoconstrictors.

6.4.1.K Given lists of statements indicating treatments, the student should be able to select the recommended treatments for:

- Sinus arrhythmia
- Sinus tachycardia
- Sinus bradycardia
- Sinus arrest
- Atrial flutter
- Premature atrial contractions
- Supraventricular tachycardia
- Atrial fibrillation
- First-degree block
- Second-degree block
- Third-degree block
- Premature ventricular contraction
- Ventricular tachycardia
- Ventricular fibrillation
- Asystole

6.4.2.K Given a list of statements, the student should be able to select the statement that best describes where the defibrillator paddles should be placed on the patient's chest.

6.4.3.K Given a list of statements, the student should be able to select the statement that best describes where the EKG electrodes should be placed on a patient.

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6.4.4.K Given a list of possible causes, the student should be able to select the causes of a poor EKG signal.

6.4.5.K Given a list of statements, the student should be able to select the statement that best describes the causes of ineffective counter shocks.

6.4.6.K* Given a list of statements, the student should be able to select the statement that best describes the possible errors made when performing the carotid massage.

6.5.1.K Given a description of a situation involving a cardiac arrest patient and a list of steps, the student should be able to select the next step to be performed.

6.5.2.K* Given a list of situations, the student should be able to select the time when cardioversion should be used.

6.5.3.K Given a list of statements, the student should be able to select the statement that best describes what to do after a cardioversion inadvertently results in ventricular fibrillation.

6.5.4.K Given a list of statements, the student should be able to select the statements that indicate when rotating tourniquets should be used.

6.5.5.K* Given a list of statements, the student should be able to select the statement that best describes how intracardiac injections are given.

Skill Objectives—1

Without receiving a lecture or a demonstration, but given an opportunity to practice the involved skills, the student should be able to perform each of the skill objectives. The student will be given no more than three attempts to perform each of the required skills in the proper sequence. Skill evaluation sheets are included in this section to assist the instructor.

*Indicates optional skill.

It is assumed that students already possess these skills; thus, a lecture or demonstration is not provided.

NOTES

6.1.S Given an adult manikin, the student will be able to correctly administer one-person cardiopulmonary resuscitation (CPR) on the manikin. "Correctly" is defined by the latest American Heart Association standards.

6.2.S Given an adult manikin and an assistant (either a fellow student or the instructor), the student should be able to perform two-person CPR. Successful performance involves:

- The administration of ventilations, while the assistant administers compressions on the manikin
- The administration of compressions, while the assistant administers ventilations to the manikin
- Switching from administrating compressions to ventilating and vice versa without the loss of adequate ventilations and compressions on the manikin

The student must correctly accomplish all three activities to complete the objective. "Correctly" is defined by the latest American Heart Association standards.

6.3.S Given an adult manikin, the student should be able to correctly perform the procedures for a witnessed cardiac arrest on the manikin. Successful performance involves:

- Procedures used before administering a precordial thump
- Delivering a precordial thump
- Procedures or steps involved after delivering a precordial thump

To complete the objective, the student must successfully complete all three activities following the criteria established by the American Heart Association.

6.4.S Given an infant manikin, the student should be able to correctly perform CPR on it. "Correctly" will be defined

by the most recent American Heart Association standards.

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Skill Objectives—2

After completing this module, the students should be able to correctly perform each of the skill objectives. "Correctly" will be defined by the instructor during the lecture and demonstration sessions. Skill evaluation sheets are included in the module.

6.3.1.S Given an EKG monitor, alcohol, alcohol pads, a plastic scouring pad, electrolytic compound, and a fellow student (or the instructor), the student should be able to monitor the "patient's" EKG. Successful performance involves:

- Setting up the equipment
- Selecting the location for the three leads
- Placing the electrodes (three); any of the following types of electrodes may be used:
  - — Silver plates
  - — Clamps
  - — Disposable disks
  - — Needles

The student must accomplish all activities within 4 minutes to successfully complete the objective.

6.4.2.S* Given an adult manikin and assuming that it is experiencing a supraventricular tachycardia arrhythmia, the student should be able to correctly administer carotid massage.

6.4.3.S Given an adult manikin, a defibrillator, electrolytic compound, and an assistant (either a fellow student or the instructor), the student should be able to defibrillate the manikin. Successful performance involves:

- The administration of CPR while the assistant sets up the equipment

*Indicates optional skill.

- Setting up the equipment while the assistant administers CPR
- The application of direct current
- The application of a synchronized shock

The student must complete activities B-D within 45 seconds to successfully attain the objective.

6.5.4.S* Given a manikin, a mechanical CPR device—either a cardiac press or an automatic gas-powered compression oxygen tank and mask—and an assistant, the student should be able to:

- Set up the equipment while the assistant initiates the CPR
- Operate the equipment while the assistant ventilates

The student must complete both activities to successfully complete the objective.

6.5.5.S* Given a cadaver, a long needle, syringe, and alcohol wipes, the student should be able to perform intracardiac injection.

Instructor Activities

Assign the material referred to below during the class period immediately before beginning the unit:

- Chapter 6, Unit 5, of the *Text*
- Skill and knowledge objectives for this unit

Present a formal lecture, only if the background of the students warrants one, on unwitnessed and witnessed cardiac arrest, and on infant resuscitation as outlined by the American Heart Association. If the students are trained and certified in basic life support, a training session should be scheduled and presented by a certified instructor of the American Heart Association.

*Indicates optional skill.

NOTES

NOTES

Prepare a lecture following the content outline on page VI-90. The following suggestions are made:

- Section 6.1 of the outline should be presented as a lecture. The summary table may be duplicated and used as a handout.
- Section 6.2 is *not* conducive to a lecture. It is included here only as a reference. The student should be instructed to use the glossary of drugs in Module IV to learn this material.
- Sections 6.3 and 6.4 should be covered with extreme care.

Prepare the following demonstrations (for your convenience, demonstration outlines are provided):

- Demonstration 6.3.1.S: EKG Monitoring
- Demonstration 6.4.2.S:* Carotid Massage
- Demonstration 6.5.3.S: Defibrillation and Cardioversion
- Demonstration 6.5.4.S:* Intracardiac Injections
- Demonstration 6.5.5.S:* Use of Mechanical CPR Devices

Supervise the following practice sessions:

- Practice Session 1: Cardiopulmonary Resuscitation
- Practice Session 2: EKG Monitoring and Carotid Massage
- Practice Session 3: Defibrillation, Cardioversion, and Mechanical CPR Devices

Prepare and conduct a dog lab on the effects of cardiac drugs. (For your convenience, a description of the dog lab is contained in this unit.)

Prepare a written test using the specified knowledge objectives.

Administer the test.

Evaluate the student's attainment of the skill objectives, using the provided skill evaluation sheets. For evaluating the skills in basic life support, the sheets developed by the American Heart Association may be substituted for the checklists provided.

*Indicates optional skill.

Equipment and Materials

Equipment—Educational

Chalkboard and chalk
Arrhythmia Annie
Resuscitation manikin

Equipment—Medical

Two adult manikins
Alcohol swabs
EKG monitor
Electrode jelly
Defibrillator
Syringes
Long (spinal) needle
Cadaver
Cardiac press
Oxygen tank (compressed air)
Automatic, gas-powered compressor
Equipment for dog lab

- EKG and blood pressure monitor
- Intubation set
- Cut-down tray
- Drugs (lidocaine, atropine, sodium bicarbonate, epinephrine, Levophed, Narcan)

Materials

Knowledge test (to be prepared by instructor)
Skill and knowledge objectives (optional)
Skill evaluation sheets
Text

Content Outline

Introduction

- Inform the students that the purpose of this unit is to:

NOTES

— Discuss antiarrhythmia drugs
— Discuss specific treatments of specific arrhythmias (dog lab)
— Demonstrate:
  a. EKG monitoring
  b.* Carotid massage
  c. Defibrillation and cardioversion
  d.* Use of mechanical CPR devices
— Discuss:
  a. Rotating tourniquets
  b.* Intracardiac injections

NOTES

- Inform the students that this unit contains:

  — Demonstration sessions
  — Practice sessions
  — One dog lab (the effects of drugs)

- Read skill and knowledge objectives.

6.1. General introduction to drugs

A. Point out that drugs administered to treat arrhythmia alter the heart's electrical properties of:
   1. Automaticity
   2. Excitability
   3. Conductivity

B. Discuss automaticity.
   1. Define it as the ability of certain pacemakers within the electrical conduction system to initiate impulses spontaneously; pacemakers influence the following:
      a. SA node
      b. Ectopic atrial pacemakers
      c. AV junction
      d. Ectopic ventricular pacemakers
   2. Point out the drugs that stimulate or increase automatic firing of pacemakers in bradyarrhythmias.
      a. Atropine
         (1) SA node

*Indicates optional skill.

(2) AV junction

b. Isoproterenol

(1) SA node

(2) Atria

(3) AV junction

(4) Ventricles

3. Point out the drugs that suppress or decrease automatic firing in tachyarrhythmia.

a. Lidocaine: ventricles

b. Procainamide and quinidine

(1) Atria

(2) AV junction

(3) Ventricles

c. Propranolol

(1) SA node

(2) AV junction

(3) Atria

(4) Ventricles

C. Discuss excitability.

1. Define it as the ability of the electrical conduction system to initiate and conduct excitation impulse and of the muscle fibers to depolarize and contract in response to that stimulation.

2. Point out the drugs that decrease excitability in tachyarrhythmias.

a. Lidocaine

(1) Bundle of His-Purkinje system

(2) Ventricles

b. Procainamide, quinidine, and propranolol

(1) Atria

(2) Bundle of His-Purkinje system

(3) Ventricles

D. Discuss conductivity.

1. Define it as the ability of the electrical conduction system to transmit excitation impulses.

2. Point out the drugs that increase electrical conductivity in bradyarrhythmias.

a. Atropine: AV node

b. Isoproterenol: AV node

c. Procainamide: atria

d. Quinidine: atria

NOTES

3. Point out the drugs that decrease electrical conductivity in tachyarrhythmias.
   a. Digoxin: AV node
   b. Propranolol: atria

E. Discuss the summary table on page VI-94.

6.2. Description of drugs

A. Atropine
   1. The primary use is to increase the heart rate in bradyarrhythmias.
   2. The action is:
      a. In general it blocks parasympathetic action on the SA node and AV junction.
      b. Physiological effect
         (1) Increases the automaticity of:
            (a) SA node
            (b) AV junction
         (2) Increases the conductivity of the AV node
      c. Hemodynamic effect
         (1) Increases the heart rate
         (2) Increases the cardiac output (when the patient is lying down)
         (3) Increases the blood pressure (when the patient is lying down)
   3. Indications—when the heart rate is below 40–50/min, one or more of the following signs are present:
      a. Systolic pressure of 80 millimeters of mercury (mm Hg) or less
      b. Weak or absent pulse
      c. Pale, cold, clammy skin
      d. Agitation, confusion, or unconsciousness
      e. Atrial or ventricular ectopic arrhythmias
         (1) Sinus bradycardia
         (2) Second-degree heart block (types I and II)
         (3) Third-degree heart block with or without premature ventricular contraction
         (4) Slow ventricular rate accompanying atrial flutter or fibrillation—very dangerous in the field
   4. The dosage (intravenous) is:
      a. 0.5 milligram (mg)

NOTES

Arrhythmia and drug	Automaticity		Excitability		Conductivity	
	Increase	Decrease	Increase	Decrease	Increase	Decrease
Bradyarrhythmia						
Atropine	SA node AV junction				AV node	
Isoproterenol	SA node Atria AV junction Ventricles				AV node	
Tachyarrhythmia						
Lidocaine		Ventricles		Bundle of His-Purkinje system Ventricle		
Procainamide and quinidine		Atria AV junction Ventricle		Atria Bundle of His-Purkinje system Ventricles	AV node	Atria
Propranolol		SA node AV junction		Atria Bundle of His-Purkinje system Ventricles	AV node	Atria
Digoxin						AV node

NOTES

b. Injected within 1 minute
c. Repeated every 5 minutes until
(1) Heart rate is between 60 and 100/min or
(2) 2 mg have been administered

5. The side effects are:
a. Dryness of mouth
b. Blurred vision
c. Urinary retention
d. Constipation
e. Worsening of preexisting glaucoma
f. Diminished sweating
g. Dilation of pupils
h. Headaches

6. Caution should be exercised because:
a. Heart rate may decrease if the dosage is too small—0.2 or 0.3 mg—or if given too slowly.
b. Decrease can cause:
(1) Premature ventricular contractions
(2) Ventricular tachycardia
(3) Ventricular fibrillation

B. Isoproterenol (Isuprel)

1. The primary use of isoproterenol is to increase the heart rate in bradyarrhythmias.

2. The action is:
a. General—beta receptor stimulator
b. Physiological effects
(1) Heart
(a) Increases automaticity of:
(i) SA node
(ii) AV junction
(iii) Atria
(iv) Ventricles
(b) Increases conductivity from atrium through the AV node
(c) Increases the force of ventricular contraction
(d) Increases cardiac work
(2) Vascular system
(a) Results in the vasodilation of the peripheral arterioles

NOTES

(b) Results in the decrease of peripheral vascular resistance

c. Hemodynamic effects

(1) Heart

(a) Increases the heart rate

(b) Increases the stroke volume

(c) Increases the cardiac output

(2) Vascular system

(a) Results in a potential decrease of systemic blood pressure

(b) Depends on the increase of cardiac output and the extent of peripheral vascular dilation

3. The indications are:

a. The drug is used before and after the insertion of an electrical pacemaker to treat AV block.

b. It may be needed to reverse bradyarrhythmias if atropine fails.

(1) Sinus bradycardia

(2) Second-degree heart block (types I and II)

(3) Third-degree heart block

4. The dosage is:

a. Sublingual administration (if atropine is not effective)

(1) Point out that 10 mg are held under the tongue.

(2) Point out that it takes effect in 15–30 minutes and lasts up to 2 hours.

b. Intravenous administration

(1) Discuss continuous drip.

(2) Point out that one ampule (5 milliliters (ml)) containing 2 mg of isoproterenol is diluted into 500 ml of 5-percent dextrose and water.

(3) 1 ml/min

c. Intracardiac administration

5. The side effects are:

a. Exercise caution in AMI; may cause arrythmia

b. Only use in bradycardias (life threatening) or cardiac standstill until an electrical pacemaker can be inserted

C. Lidocaine

1. The primary use of lidocaine is to suppress ventricular ectopic activity.

NOTES

2. The action is:
   a. General—it depresses the electrical properties of:
      (1) Bundle of His-Purkinje system
      (2) Ventricles
   b. Physiological effect
      (1) Decreases the automaticity of ectopic foci in bundle of His-Purkinje system
      (2) Decreases the excitability of:
         (a) Bundle of His-Purkinje system
         (b) Ventricles, by decreasing the response to electrical stimuli
      (3) Decreases the force of ventricular contractions
      (4) Decreases peripheral vascular resistance (slightly)
   c. Hemodynamic effects
      (1) Suppresses ventricular ectopic activity
      (2) Decreases cardiac output (slightly)
      (3) Decreases systemic blood pressure
3. The indications are:
   a. Premature ventricular contractions
   b. Ventricular tachycardia
   c. Ventricular fibrillation (recurrence after direct-current conversion)
   d. Ventricular arrhythmias associated with digitalis toxicity
4. The contraindications are:
   a. Persons with a history of allergy to similar drugs (e.g., Novocain)
   b. Second-degree heart block
   c. Complete heart block
   d. History of fainting
   e. Sinus bradycardia
5. The dosages are:
   a. Intravenously
      (1) Point out that it is given rapidly.
      (2) Point out that 1 to 2 mg are given per kilogram (kg) of the patient's weight.
      (3) Point out that 50 to 75 mg are given in 30 to 60 seconds.
      (4) Point out that this procedure is repeated until arrhythmia is suppressed or until three dosages have been given within 1 hour.

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(5) Point out that continuous drip is administered as soon as possible after IV bolus.

(a) Point out that 2,000 mg of lidocaine is diluted into 500 ml of 5-percent dextrose and water.

(b) Point out that each milliliter of diluted solution contains 4 mg of lidocaine.

(c) Point out that the rate is 1 to 4 mg/min.

b. Intramuscularly

(1) Point out that the dosage is 200 mg.

(2) Point out that it is administered at the same time as the IV bolus.

6. The side effects (if the above-recommended levels are administered) are:

a. Depression of automatic firing of SA node causing:

(1) Sinus bradycardia

(2) Sinoatrial block

(3) Cardiac arrest

b. Depression of the AV junction causing AV heart block

c. Depression of the bundle of His-Purkinje system causing wide QRS complexes

d. Numbness

e. Drowsiness

f. Convulsions

g. Hypotension (rarely)

D. Procainamide and quinidine

1. In general, these drugs are used to suppress rapid supraventricular tachycardia and ventricular ectopic activity that are not responding to lidocaine.

2. The action is:

a. Physiological effects

(1) Decreases the rate of automatic firing of:

(a) Ectopic foci in the atria

(b) AV junction

(c) Bundle of His

(d) Bundle of His-Purkinje system of ventricles

(2) Decreases the transmission of excitation impulses through:

(a) Atria

(b) Bundle of His

NOTES

(c) Bundle of His-Purkinje system

(3) Increases the transmission of the excitation impulse from the atria through the AV node by blocking the parasympathetic activity of the AV node

(4) Decreases the excitability of the atrium and ventricle

(5) Decreases the force of ventricular contractions

b. Hemodynamic effects

(1) Suppresses atrial, AV junctional, and ventricular ectopic activity

(2) Decreases the heart rate

(3) Decreases the stroke volume

(4) May decrease the cardiac output

(5) May decrease the systemic blood pressure

3. Indications are for the treatment and prophylactic management of:

a. Premature and ventricular contraction uncontrolled by lidocaine

b. Ventricular tachycardia uncontrolled by lidocaine

4. The dosage is:

a. Procainamide (not endorsed for field use)

(1) Point out that it is given intravenously as a continuous drip.

(2) Point out that 2,000 mg are diluted in 500 ml of saline or 5-percent dextrose and water solution.

(3) Point out that each milliliter of solution contains 4 mg of procainamide.

(4) Point out that it can be administered orally—250–500 mg every 3 to 4 hours after an initial dose of 500–1,000 mg.

b. Quinidine (not endorsed for field use)

(1) Intravenously

(2) Intramuscularly

(3) Orally

(a) Usual type of administration

(b) 200–600 mg every 6 hours

E. Propranolol (Inderal) (not for field use)

1. It is generally used to suppress ventricular ectopic activity and rapid supraventricular tachyarrhythmias

NOTES

that are not responding to the usual antiarrhythmia drugs.

2. The action is:
   a. Physiological
      (1) Decreases the rate of automatic firing of the SA node or the ectopic foci in the atria, the AV junction, the bundle of His, or the bundle of His-Purkinje system
      (2) Decreases the electrical conductivity through the atria and the bundle of His
      (3) Decreases the force of ventricular contraction
      (4) Decreases cardiac work
   b. Hemodynamic effects
      (1) Decreases the heart rate
      (2) Decreases the stroke volume
      (3) Decreases cardiac work
3. The indications are:
   a. Arrhythmias
      (1) Sinus tachycardia
      (2) Atrial premature contractions
      (3) Paroxysmal atrial tachycardia
      (4) Atrial flutter
      (5) Atrial fibrillation
   b. Premature ventricular contraction and tachycardia uncontrolled by lidocaine and procainamide
   c. Supraventricular arrhythmias with rapid ventricular rates caused by digitalis overdose
      (1) Paroxysmal atrial tachycardia
      (2) Atrial flutter
      (3) Atrial fibrillation
4. The contraindications are:
   a. Sinus bradycardia
   b. Second-degree heart block
   c. Third-degree heart block
   d. Cardiogenic shock
   e. Congestive heart failure
   f. Asthma, chronic obstructive pulmonary disease
5. The dosage is:
   a. Point out that it is given intravenously.
   b. Point out that 1 to 3 mg are administered.

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c. Point out that the rate is slow:
1 mg/min.
d. Point out that it may be repeated only once.

6. The side effects are:
a. Bradycardia
b. Hypotension and shock
c. Pulmonary congestion and edema
d. Bronchial wheezing

F. Digoxin (not used in the field)

1. It is generally used to decrease rapid ventricular rates in supraventricular tachyarrhythmias and to improve contraction in congestive heart failure.
2. The action is:
a. Within therapeutic doses
(1) Physiological
(a) Decreases the rate of automatic firing of the SA node (slightly)
(b) Increases the excitability and conduction rate of the atria (slightly)
(c) Decreases the electrical conduction or transmission of excitation impulses from the atria through the AV node
(d) Increases the force of ventricular contraction
(2) Hemodynamic effects
(a) Decreases the ventricular rate in supraventricular tachyarrhythmias
(b) Increases the cardiac output in diseased hearts
(c) Increases cardiac work
(d) Decreases edema
b. Beyond therapeutic doses
(1) Physiological effects
(a) Increases the rate of automatic firing of the SA node, ectopic foci in the atria, AV junction, or the bundle of His-Purkinje system
(b) Decreases the excitability and conduction rate of the atria and the bundle of His-Purkinje system
(2) Hemodynamic effect enhances:

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(a) Supraventricular and AV junctional tachyarrhythmias
(b) AV block
(c) Ventricular ectopic activity

3. The indications are:
   a. Treatment of congestive heart failure
   b. Treatment of supraventricular arrhythmias with fast rates, such as:
      (1) Atrial flutter
      (2) Atrial fibrillation
      (3) Paroxysmal atrial or AV junctional tachycardias
      (4) Premature ventricular contraction
4. The side effects may cause the following:
   a. Cardiac—any arrhythmia, including:
      (1) Sinus arrhythmia
      (2) Bradycardia
      (3) SA node block
      (4) Paroxysmal atrial tachycardia
      (5) AV junctional rhythm
      (6) AV junctional tachycardia
      (7) AV heart block
      (8) AV disassociation
      (9) Premature ventricular contraction
      (10) Ventricular tachycardia
   b. Gastrointestinal
      (1) Loss of appetite
      (2) Nausea
      (3) Vomiting
   c. Visual
      (1) Yellow vision
      (2) Spots
      (3) Blurring
      (4) Shimmering
   d. Neurologic
      (1) Headache
      (2) Fatigue
      (3) Insomnia
      (4) Depression
   e. Endocrine—tingling of the breast

NOTES

G. Other drugs
   1. Alkalizing agents—sodium bicarbonate
   2. Cardiotonic drugs
      a. Epinephrine
      b. Calcium chloride
   3. Antihypotensive drugs
      a. Metaraminol (Aramine)
      b. Norepinephrine (Levophed)
   4. Drugs for pain, anxiety
      a. Morphine sulfate
      b. Diazepam (Valium)
   5. Drugs for congestive heart failure
      a. Furosemide (Lasix)
      b. Morphine sulfate
   6. Anticoagulants
      a. Coumadin
      b. Heparin

H. Descriptions
   1. Alkalizing agents—sodium bicarbonate
      a. It is generally used to treat metabolic acidosis occurring in hypotension, shock, or cardiac arrest.
      b. Its action neutralizes acidosis.
         (1) Physiological effects
            (a) Increases depressed sympathetic activity to a normal level
            (b) Decreases accentuated parasympathetic action on the SA node and AV node to normal
            (c) Increases the rate of automatic firing of the SA node or ectopic pacemaker in the AV junction
            (d) Improves the condition of excitation impulses from the atria through the AV node, AV junction, bundle of His, and bundle of His-Purkinje system
            (e) Increases the force of ventricular contraction
         (2) Hemodynamic effects
            (a) Increases the heart rate
            (b) Increases the stroke volume
            (c) Increases cardiac output

NOTES

(d) Increases blood pressure

(e) Enhances drug treatment and direct-current conversion of ectopic activity

c. The indication is that it is administered in cases of shock and cardiac arrest

d. The contraindications are:

(1) Do not administer to patients with low blood potassium, alkalosis, severe heart damage or congestive heart failure

(2) Discontinue if its use results in premature ventricular contraction

e. The dosage is:

(1) One ampule for every 5 minutes of shock or cardiac arrest

(2) No more than three ampules without evaluating blood pH, electrolytes, and gases

f. Side effect—an excessive amount increases blood volume and can cause congestive heart failure

2. Cardiotonic drugs

a. Epinephrine

(1) It is generally used to stimulate the heart and improve the force of ventricular contractions in cardiac arrest.

(2) The action is:

(a) Physiological

(i) Produces vasoconstriction of peripheral arterioles

(ii) Increases vascular resistance

(b) Hemodynamic effect—increases systolic pressure

(c) Physiological effects on the heart

(i) Increases the automatic firing of the SA node or ectopic focus in the AV junction, bundle of His, bundle of His-Purkinje system

(ii) Increases the force of ventricular contraction

(iii) Increases the heart rate

(iv) Increases the stroke volume

(v) Increases cardiac output

NOTES

(vi) Enhances the effectiveness of external cardiac compressions

(vii) Enhances the direct-current conversion of ventricular fibrillation

(3) The indications are:

(a) Treatment of ventricular fibrillation

(b) Treatment of cardiac standstill

(4) The dosage is:

(a) Intravenously—5–10 ml of 1:10,000 solution

(b) Intracardiac—5 ml solution injected into the left ventricular cavity

b. Calcium chloride

(1) It is generally used to stimulate the heart to beat during asystole and improve ventricular contractions following cardiac arrest.

(2) The action is:

(a) Physiological

(i) Increases the rate of automatic firing of the SA node or ectopic focus in the AV junction, bundle of His, bundle of His-Purkinje system

(ii) Increases the force of ventricular contraction

(b) Hemodynamic effects

(i) Increases the heart rate

(ii) Increases the stroke volume

(iii) Increases cardiac output

(iv) Increases blood pressure

(3) The indications are:

(a) During treatment of cardiac arrest, calcium chloride is used if sodium bicarbonate and epinephrine are not effective in restoring cardiac output.

(b) Calcium chloride is also used if precordial thump, CPR, and sodium bicarbonate are not effective in restoring heartbeat.

(4) The contraindications are:

(a) Should not be given during ventricular fibrillation

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(b) Should not be given to patients fully digitalized

(5) The dosage is intravenous.

(a) The initial dose is 0.5 gram (5 ml), administered slowly over a 5-minute period.

(b) The dosage is repeated as often as needed.

3. Antihypotensive drugs

a. Metaraminol (Aramine)

(1) It is generally used to increase systemic blood pressure in hypotension or shock.

(2) The action is:

(a) Peripheral arterioles

(i) Point out the physiological effects

- Produces vasoconstriction of peripheral arterioles
- Increases peripheral vascular resistance

(ii) Point out the hemodynamic effect—increase in systolic and diastolic blood pressure

(b) Heart

(i) Point out the physiological effects

- Increases the rate of automatic firing of the SA node
- Increases the force of ventricular contraction
- Dilates coronary arteries

(ii) Discuss the hemodynamic effects

- Increases the heart rate
- Increases the stroke volume
- Increases cardiac output

(3) The indications are:

(a) Treatment of hypotension

(b) Shock

(4) The contraindication is hypotension from blood loss.

(5) The dosage is:

(a) Intramuscularly or subcutaneously

(i) Point out that the dosage is 2 to 10 mg.

(ii) Point out that its effects last about 20 minutes.

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(b) Intravenously

(i) Point out that it is administered in a continuous drip.

(ii) Point out that the dosage is 15 to 200 mg diluted in 500 ml of saline or 5-percent dextrose and water.

(iii) Point out that the rate is set to maintain a systolic blood pressure of 100–120 mm Hg.

b. Norepinephrine (Levophed)

(1) It is generally used to increase systemic pressure in hypotension and shock.

(2) The action is:

(a) Peripheral arterioles

(i) Discuss the physiological effects.

- Produces vasoconstriction of peripheral arterioles
- Increases peripheral vascular resistance

(ii) Discuss the hemodynamic effect—increases systolic blood pressure

(b) Heart

(i) Discuss the physiological effects.

- Increases the rate of automatic firing of the SA node
- Increases the force of ventricular contraction
- Dilates the coronary arteries

(ii) Discuss the hemodynamic effects.

- Increases the heart rate
- Increases the stroke volume
- Increases cardiac output

(3) The indications are:

(a) Point out that it is used to treat hypotension and shock.

(b) Point out that it is used to increase cardiac output.

(4) The contraindication is not for use in hypotension resulting from loss of blood

(5) The dosage is given intravenously.

(a) Continuous drip

NOTES

(b) One ampule (4 ml) containing 4 mg of Levophed is diluted into 1,000 ml of 5-percent dextrose and water.

(6) The side effect is that a dose over recommended levels can cause ventricular arrhythmia, severe hypertension, severe headache, sweating, vomiting, anxiety, and respiratory difficulty.

4. Pain and anxiety

a. Morphine sulfate

(1) It is generally used to alleviate severe pain of AMI and decrease pulmonary edema.

(2) The action is:

(a) Decreases pulmonary edema by lessening the venous return to the heart

(b) Reduces systemic vascular resistance and blood pressure

(3) The indications are:

(a) Pain from AMI

(b) Severe dyspnea of pulmonary edema

(4) The dosage is:

(a) Point out that it is given intravenously.

(b) Point out that 10 mg are diluted in 10 ml of D5W.

(c) Point out that the dosage should be titrated until the patient experiences pain relief.

(d) Point out that it should not be given intramuscularly or subcutaneously in the field.

(e) Point out that the smallest possible dose that is effective should be used.

(5) The side effects are:

(a) Hypotension

(b) Bradycardia

(c) Nausea

(d) Vomiting

(6) A note on the use of morphine sulfate:

(a) To avoid hypotension, elevate the patient's legs.

(b) To avoid bradycardia, administer atropine.

b. Diazepam (Valium)

(1) It is generally used to relieve tension and anxiety.

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(2) The action is to produce a calming effect and amnesia.
(3) The indications are pain and anxiety.
(4) The contraindications are:
(a) Do not administer to infants
(b) Exercise caution if the patient is pregnant
(5) The dosage is:
(a) Point out that it can be given intravenously or intramuscularly in 5 to 10 mg doses.
(b) Point out that the dose can be repeated in 1 to 4 hours.
(6) The side effects are:
(a) Respiratory and cardiac arrest
(b) Hypotension
(c) Muscular weakness
(d) Decreased mental alertness

5. Congestive heart failure
a. Digoxin (already discussed)
b. Morphine sulfate (already discussed)
c. Furosemide (Lasix)
(1) It is used primarily to remove fluid retained in congestive heart failure.
(2) The action is:
(a) Inhibits tubular reabsorption of sodium in kidney
(b) Causes chloride excretion, potassium excretion, and water diuresis
(3) The indications are edema and pulmonary edema due to congestive heart failure.
(4) The contraindication shows it should not be administered to pregnant women or women of childbearing age.
(5) The dosage is:
(a) Severe congestive heart failure—40 mg injected slowly in IV over a 1– to 2-minute period
(b) Mild congestive heart failure—40 mg injected intramuscularly or intravenously
(6) The side effects are:
(a) Electrolyte depletion (especially potassium)
(b) Dehydration

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(c) Allergic reaction
(d) Nausea and vomiting

6. Anticoagulants
7. Lab Session 1: Effects of Drugs
8. Practice Session 1: Basic Life Support

6.3. EKG monitoring—introduce Demonstration 6.3.1.S

6.4. Arrhythmia and treatments

A. Arrhythmia requiring no treatment
1. Sinus arrhythmia (could be a normal phenomenon)
2. Sinus tachycardia
a. Point out that the EMT must treat the underlying cause.
b. Discuss potential causes.
(1) Pain
(2) Fever
(3) Congestive heart failure
(4) Hypotension
(5) Shock
(6) Hypoxia
(7) Atropine or epinephrine overdose
3. Atria flutter (monitor carefully)—may have to cardiovert if associated with hypotension

B. Arrhythmias requiring treatment
1. Sinus bradycardia
a. No treatment unless one of the following is present:
(1) Systolic blood pressure of 80 mm Hg or less
(2) Weak or absent pulse
(3) Cold and clammy skin
(4) Unconsciousness
b. Treatment
(1) Administer 0.5-mg bolus of atropine IV
(2) Repeat every 5 minutes until the rate is above 70 beats per minute
(a) Do not administer more than 2 mg
(b) If atropine is ineffective, administer 10 mg of isoproterenol sublingually
2. Premature atrial contraction—no treatment in the field
3. Supraventricular tachycardia

NOTES

a.* Point out that the EMT must administer carotid massage.

b. Introduce Demonstration 6.3.2.S.

4. Atrial fibrillation—rate over 120–140 and low cardiac output—cardiovert*

5. First-degree block

   a. Point out that there is no specific treatment, but the EMT must monitor carefully.

   b. Point out that it may progress to:

      (1) Second-degree block

      (2) Third-degree block

6. Second-degree block (type I and type II)

   a. No treatment

   b. Treatment if one of the following is present:

      (1) Systolic pressure of 80 mm Hg or less

      (2) Weak or absent pulse

      (3) Cold and clammy skin

      (4) Unconsciousness

   c. Treatment

      (1) Point out that the EMT must administer a 0.5 mg bolus of atropine.

      (2) Point out that this dose should be repeated every 5 minutes until the rate is above 70 beats per minute.

         (a) Do not administer more than 2 mg.

         (b) If atropine is ineffective, administer 10 mg of isoproterenol sublingually

7. Third-degree block (See second-degree block.)

8. Premature ventricular contraction

   a. Administer 50 to 75 mg of lidocaine, slowly (Note: dosage is based on the patient's weight)

   b. Repeat every 5 minutes (do not exceed three dosages in 1 hour or 5 mg/kg of body weight)

   c. Upon conversion, use lidocaine drip

      (1) 2,000 mg in 500 ml of 5-percent dextrose and water

      (2) 1 to 3 mg/min

NOTES

*Indicates optional skill.

9. Ventricular tachycardia
   a. If the patient is alert with no signs of inadequate cardiac output
      (1) Administer 50–75 mg lidocaine (1 mg/kg of body weight)
      (2) Repeat every 3 to 5 minutes
      (3) Do not exceed three dosages in 1 hour
      (4) If the patient begins to lose consciousness and shows signs of decreased output, cardiovert
   b. If the patient has signs of inadequate cardiac output, that is, hypotension, confusion, or coma
      (1) Cardiovert—25 watt-seconds
      (2) Administer lidocaine as described above
10. Ventricular fibrillation
   a. Point out that this situation requires immediate defibrillation.
   b. Point out that the steps involved will be discussed later (Section 6.5A3).
11. Practice Session 2

6.5. Techniques and procedures (not discussed above)

A. Cardiac arrest: advanced life support
   1. Discuss the American Heart Association's definition of advanced basic life support.
      a. Discuss the use of adjunctive equipment for ventilation and circulation.
      b. Discuss cardiac monitoring for dysrhythmia recognition and control.
      c. Discuss defibrillation.
      d. Point out that the EMT must establish and maintain an intravenous infusion line.
      e. Point out that the EMT must employ definitive therapy, including drug administration:
         (1) To correct acidosis
         (2) To aid in establishing and maintaining an effective cardiac output and circulation
      f. Point out that the EMT must stabilize the patient's condition.
      g. Point out that the EMT must transport the patient with continuous monitoring.

NOTES

2. Point out that the use of airway adjuncts was discussed in Module V.
3. Discuss the steps involved in the treatment of a cardiac arrest patient.
   a. Immediately begin CPR.
   b. Apply lubricated paddles to the patient's chest for a quick look.
   c. If ventricular fibrillation is present, immediately countershock. Hold the paddles in place and monitor; if the monitor shows sinus rhythm, check for a pulse. If the monitor shows asystole or ventricular fibrillation, resume the above sequence of events (a-c).
   d. If defibrillation is unsuccessful, do the following:
      (1) Continue CPR
      (2) Intubate
      (3) Start IV, D5W
   e. Start drug therapy.
      (1) Sodium bicarbonate—50–100 milliequivalent (50–100 ml) IV
      (2) Epinephrine, 5 ml of 1:10,000 solution IV
   f. Continue external cardiac compression to circulate drugs.
   g. Apply monitoring electrodes.
   h. If ventricular fibrillation is present, countershock.
      (1) If asystole or electromechanical dissociation is present, remember that other drugs, including calcium, will be necessary.
      (2) If normal sinus rhythm is seen in the EKG, check the pulse.
   i. If ventricular fibrillation is still present or recurs with short periods of normal sinus rhythm, give 50 ml of sodium bicarbonate and 75–100 mg of lidocaine by an IV bolus.
      (1) If fibrillation is fine, administer epinephrine.
      (2) If fibrillation persists after multiple shocks, reassess the ventilation and consideration of drugs (bicarbonate, epinephrine, etc.).
   j. If normal sinus rhythm returns, but with a bradycardia and hypotension, administer atropine (every 5 minutes to a total of 2.0 mg).

NOTES

k. Administer to all defibrillated patients an infusion of lidocaine.

B.* Cardioversion

1. Purpose
   a. Point out that the purpose is to terminate dysrhythmias other than ventricular fibrillation.
   b. Point out that the current is synchronized, so that shock will not be delivered at the T wave.
   c. Discuss indications.
      (1) Rapid ventricular tachycardia
      (2) Atrial flutter with hypotension, signs of poor perfusion
      (3) Atrial fibrillation with a rapid ventricular response and hypotension, signs of poor perfusion
   d. Point out that cardioversion is usually performed on unconscious or stuporous patients.
2. Procedures (Demonstration 6.5.3.S)
   a. Turn the synchronized button to the "on" position.
   b. Turn the main power switch on.
   c. Set the energy level as ordered by physician—energy levels will vary.
   d. Prepare the paddles (same as for defibrillation).
   e. Depress the paddles and keep them depressed until the synchronizer fires (10 milliseconds after the peak of an R wave).
   f. If ventricular fibrillation is caused, do the following immediately:
      (1) Recharge the defibrillator to maximum.
      (2) Turn the synchronizer circuit to "off."
      (3) Shock the patient again.

C. Rotating tourniquets

1. Purpose—to reduce the circulating volume in cases of congestive heart failure
2. Procedure
   a. Tourniquets are fastened to three of the four extremities to prevent venous return.
      (1) Do not apply them so tightly that they cut off arterial inflow.

NOTES

*Indicates optional skill.

(2) Check the palpable pulse distal to tourniquet after application.

b. Tourniquets are then rotated every 5 minutes so each limb has impaired circulation for 15 out of 20 minutes.

c. The EMT rotates the tourniquets in a counterclockwise direction.

D.* Intracardiac injections

1. Introductory comments

a. Point out that they are usually used when an intravenous route cannot be readily established during cardiac arrest (injection of epinephrine).

b. Point out that there are no particular advantages over the instillation of epinephrine through the endotracheal tube.

c. Discuss some hazards.

(1) Laceration of coronary artery

(2) Inadvertent injection into myocardial tissue

(3) Pneumothorax

(4) Cardiac tamponade

d. Discuss the disadvantage which requires the interruption of ventilations and compressions.

2. Procedures (see Demonstration 6.5.4.S)

a. Connect a long (spinal) needle, 20–22 gage, to a syringe of epinephrine, if it is not already attached.

b. Locate fourth or fifth left intercostal space approximately 1.5 inches to the left of the sternal border.

c. Cleanse the area with an alcohol or iodine swab.

d. Insert the needle at right angles to the chest wall, maintaining a slight pull on the plunger.

e. Inject the contents of the syringe when free aspiration of blood is encountered—the tip of the needle has entered the ventricular lumen.

f. Rapidly withdraw the needle and resume external cardiac compressions.

E.* Mechanical CPR devices

1. Advantages

a. Reduce or eliminate operator fatigue

NOTES

*Indicates optional skill.

b. Decrease the number of personnel required to perform CPR
c. Useful for extended CPR during transport

2. Additional comments
   a. Safety and efficiency have not been conclusively established
   b. Extensive training and frequent team drills are required
   c. None of these devices should be used to initiate CPR
3. Types
   a. Cardiac press
   b. Automatic gas-powered compression
4. Demonstration 6.5.5.S
5. Practice Session 3

NOTES

Dog Lab 1

NOTES

Introduction

This lab experience teaches the student when to use the following treatments:

- Lidocaine
- Atropine
- Epinephrine
- Levophed
- Narcan (optional)
- Sodium bicarbonate
- Defibrillation

and the effects of these treatments. It should follow the lectures, which discuss the drugs given above and defibrillation.

Procedure

To prepare the dog for the lab, it is necessary to:

- Anesthesize the dog.
- Intubate the dog.
- Perform a cut down.
  - — Insert an arterial infusion line.
  - — Insert a venous pressure line.
- Monitor the dog's EKG using three leads.
- Hook up the arterial pressure line to monitor the blood pressure.

The students may or may not be present during these preliminary procedures. If the students are present, they may be directed to assist in preparing the dog (e.g., intubate).

Once the dog is prepared, have the students observe the dog's rhythm and blood pressure. Discuss the relationship between the EKG and blood pressure.

Next, cause the dog to go into cardiac arrest by electrical shock or asphyxiation. Have the students observe the EKG and blood pres-

sure. Perform CPR and have the students observe the readings. Administer sodium bicarbonate and epinephrine and defibrillate.

Once defibrillation has been effective, treat the resulting arrhythmias. Also, administer the proper treatments for the resulting blood pressure readings. Continually explain to the students the treatments, and have them monitor the EKG and blood pressure.

NOTES

Equipment

Dog
EKG and blood pressure monitor
Intubation set
Cut-down tray
Drugs

- Lidocaine
- Atropine
- Sodium bicarbonate
- Epinephrine
- Norepinephrine
- Naloxone (Narcan)—optional
- Morphine

Defibrillator
Syringes
Electrolyte jell
Alcohol
Alcohol swabs

Demonstration 6.3.1.S: EKG monitoring

NOTES

Equipment

Student posing as a patient
EKG monitor
Electrodes

- Silver plate
- Clamp
- Disposable
- Needles

Electrolyte jelly
Alcohol swabs

Procedure

Describe the steps and procedures as they are demonstrated.

Demonstrate the steps so that all the students can see what is happening.

Allow the students to ask questions as you demonstrate.

Inform the students that they need not take notes during the demonstration.

Steps

1. Check the equipment for:
   a. Broken cables
   b. Broken connectors
   c. Clean electrodes
2. Select locations for all positive and negative electrodes for the three leads.
   a. Explain possible locations for all electrodes by leads.
   b. Explain the location for ground wire.
   c. Explain the purpose of the ground wire.
3. Remove anterior clothing on the patient to expose the thorax.
   a. Explain why.
   b. Explain and demonstrate why and how the locations should be cleaned.
   c. Use abrasive pads, if necessary.

4. Discuss the different kinds of electrodes, and when and where they should be used.
   a. Silver plate
   b. clamp
   c. Dry disposable stick on disks
   d. Needles
5. Attach electrodes.
   a. Explain how to attach each type of electrode.
   b. Demonstrate.
6. Assess the signal.
7. Discuss the causes of a poor signal:
   a. Oily, dirty skin
   b. Excessive hair
   c. Dirty electrodes
   d. Dried compound
   e. Improperly applied disks
   f. Dislodged or loose electrode
   g. Patient movement
   h. Muscle tremor
   i. Broken cable tips
   j. Broken cable wires
   k. Broken connectors
   l. Faulty ground
   m. Faulty electronic equipment

NOTE: After the demonstration, ask the students if they have any questions or if they would like to see part of the demonstration repeated. Depending on the approach and schedule, the instructor may want the students to practice at this time or at least have one student repeat the demonstration, with the instructor talking the student through the skill, pointing out the errors.

NOTES

Demonstration 6.4.2.S:* Carotid Massage

NOTES

Equipment

Manikin (adult)

Procedure

Describe the steps as they are demonstrated.

Demonstrate so that all students can see the steps as they are demonstrated.

Inform the students that they need not take notes during the demonstration.

Tell the students to ask questions if they do not understand.

Steps

1. Explain when to use the procedure.
2. Position the manikin on its back.
3. Monitor the patient's EKG.
4. Hyperextend the neck.
5. Tilt the head to either side.
6. Gently palpate each carotid pulse separately to be certain that the pulses are equal. If the pulses are unequal, the process should not be used.
7. Place the index and middle fingers over the carotid artery below the angle of the jaw and as high up in the neck as possible.
8. Explain and demonstrate how to massage the artery. Maintain pressure no longer than 15–20 seconds, always watching the monitor.
9. Repeat the procedure on the other side if it is still ineffective, after 2 or 3 minutes.
10. Discuss the caution that should be exercised.
    a. Constantly monitor the EKG.
    b. Have the defibrillator available and all drugs and equipment for resuscitation readily available.
    c. Never massage both arteries simultaneously.

*Indicates optional skill.

11. Discuss the complications:
    a. Asystole
    b. Premature ventricular contractions
    c. Ventricular tachycardia
    d. Ventricular fibrillation
    e. It can interfere with cerebral circulations causing:
        (1) Syncope
        (2) Convulsions
        (3) Hemiplegia
    f. It can cause an increase in parasympathetic activity producing:
        (1) Hypotension
        (2) Wheezing
        (3) Nausea
        (4) Vomiting

NOTE: After the demonstration, ask the students if they have any questions or if they would like to see part of the demonstration repeated. Depending on the approach and schedule, the instructor may want the students to practice at this time or at least have one student repeat the demonstration, with the instructor talking the student through the skill, pointing out the errors.

NOTES

Demonstration 6.5.3.S: Defibrillation

NOTES

Equipment

Arrhythmia Annie
Adult manikin
Defibrillator
Electrode jelly
An assistant

Procedure

Demonstrate the steps and procedures involved in delivering a direct shock as well as a cardioversion.

Demonstrate so that all the students can see the steps being performed.

Describe the steps as they are being demonstrated.

Inform the students that they need not take notes during the demonstration. Encourage the students to ask questions during the demonstration.

Set up Arrhythmia Annie and manikin prior to demonstration.

Steps

1. Explain when the technique is used.
2. Display the equipment.
3. Explain and demonstrate procedures.
   a. Technician 1
      (1) Do the primary survey.
      (2) Start the CPR.
   b. Technician 2
      (1) Ready the equipment.
      (2) Bare the patient's chest.
      (3) Turn on the equipment to charge it—explain charging.
      (4) Apply electrode jelly to the paddles.
      (5) Inform technician 1, "Equipment is ready."
   c. Technician 1
      (1) Request the paddles.
      (2) Receive the positive paddle (usually coded red) in the left hand.

(3) Receive the negative paddle
(4) Place the positive paddle below the patient's left nipple.
(5) Place the negative paddle on the patient's upper chest—explain the location.
(6) Press the paddles firmly against the patient's chest.
(a) Verify arrhythmia
(b) If ventricular tachycardia or fibrillation occurs, proceed.
(7) When ready, say "Stand back. Defibrillate on three ... One, two, three."
(8) On "three," press the buttons on the paddles.
(9) Observe the scope.

4. Explain when another shock is appropriate.
5. Explain that it is important to not stop CPR efforts during the process because if the paramedic touches the patient while shocking occurs, he gets the current, too.
6. Discuss time frames associated with each activity:
   a. Ten seconds to check the pulse on a monitor after the counter shock
   b. Fifteen to twenty seconds to apply the paddles, shock, and check the monitor and pulse
7.* Discuss cardioversion:
   a. Turn the synchronizer button to the "on" position.
   b. Turn the main switch on.
   c. Set the energy level to the level ordered by the physician.
   d. Prepare the paddles.
   e. Depress the buttons.
   f. If ventricular fibrillation follows, immediately recharge the defibrillator to maximum energy position—turn off the synchronizer circuit and deliver shock.

NOTE: After the demonstration, ask the students if they have any questions or if they would like to see part of the demonstration repeated. Depending on the approach and schedule, the instructor may want the students to practice at this time or at least have two students repeat the demonstration, with the instructor talking the students through the skill, pointing out the errors.

NOTES

*Indicates optional skill.

Demonstration and Practice 6.5.4.S:* Intracardiac Injection

NOTES

Equipment

Syringe
(Spine) needle
Alcohol swabs
Cadaver

Procedure

Demonstrate so that all the students can see each step as it is performed.

Inform the students that they do not have to take notes during the demonstration. Encourage them to ask questions during the examination.

Describe each step as it is demonstrated.

After the demonstration is completed, have the students practice the skill using the same cadaver.

Steps

1. Connect a long (spinal) needle—20–22 gage—to a syringe of epinephrine.
2. Demonstrate how to locate the fourth and fifth left intercostal space.
3. Demonstrate how to cleanse the area: What material is used?
4. Insert the needle:
   a. Discuss and demonstrate how.
   b. Angle to the chest wall.
   c. Discuss the depth of the needle.
5. Inject the drug.
   a. Discuss when.
   b. Take care not to pull the needle out too soon.
6. Rapidly withdraw the needle.
7. Immediately resume external cardiac compression.

NOTE: After the demonstration, ask the students if they have any questions or if they would like to see part of the

*Indicates optional skill.

demonstration repeated. Depending on the approach and schedule, the instructor may want the students to practice at this time or at least have one student repeat the demonstration, with the instructor talking the student through the skill, pointing out the errors.

NOTES

Demonstration 6.5.5.S:* Mechanical CPR devices

NOTES

Equipment

Cardiac press (manually operated chest compressor)
Automatic, gas-powered compressor
Adult manikin
Oxygen tank (compressed air)
Assistant

Procedure

Inform the students that they do not have to take notes during the demonstration session. Encourage the students to ask questions during the demonstration.

Demonstrate the steps and procedures so that all the students can see.

Give the students an opportunity to look at the equipment before you begin the demonstration.

Steps—Cardiac Press

1. Have the assistant initiate a one-person CPR (and continue it).
2. Explain how to slide the backboard of the press under the patient's back:
   a. Demonstrate the procedure.
   b. Show the backboard.
3. Explain and demonstrate how to place the frame into position. Display the proper position.
4. Explain and demonstrate how to adjust the knob to position the plunger over the chest.
   a. Explain how the knob needs a periodic check.
   b. Explain consequences of having the plunger in an incorrect position.
5. Explain and demonstrate how to operate the handle (compressions being delivered one per second).
6. Have the assistant interpose ventilation after every fifth compression.

*Indicates optional skill.

Steps—Mechanical, gas-powered compressor

1. Have the assistant initiate CPR (usual method).
2. Secure the equipment. Explain and demonstrate how.
3. Have the assistant roll the patient on his side (explain and demonstrate how).
   a. Discuss the time limit (5 seconds).
   b. Discuss and demonstrate how the second rescuer positions the base plate under the patient.
4. Have the assistant roll the patient to a supine position and resume CPR.
5. Explain and demonstrate how to mount, position, and place the automatic chest compressor (discuss consequences of plunger being misplaced).
6. Have the assistant interpose ventilation after every fifth compression.
7. Explain and demonstrate how to set up ventilation equipment.
   a. Discuss how to switch to ventilation equipment.
   b. Watch the chest rise.
8. Check the carotid pulse with each compression.

NOTE: After the demonstration, ask the students if they have any questions or if they would like to see part of the demonstration repeated. Depending on the approach and schedule, the instructor may want the students to practice at this time or at least have one student repeat the demonstration, with the instructor talking the student through the skill, pointing out the errors.

NOTES

Practice Session 1

NOTES

Introduction

Practice Session 1 is designed to give the students an opportunity to refresh their ability to perform:

- One-person CPR
- Two-person CPR
- Precordial thump
- Infant CPR

By practicing, students should be able to complete Skill Objectives 6.1.S through 6.4.3.S.

It is anticipated that the students will not need formal training in these skills; thus, no lectures or demonstrations are given. It is assumed that students already know how to perform these skills, but need an opportunity to enhance their proficiency by practicing. After the students have all had an opportunity to practice all of the skills, they can be evaluated using Skill Evaluation Sheets 6.1.S, 6.2.S, and 6.3.S. Note that Skill Evaluation Sheet 6.1.S is used to evaluate both one- and two-person CPR.

Procedure

Divide the class into three groups:

1. Groups 1 and 2:
   a. Equipment
      (1) Adult recording manikin
      (2) Alcohol swabs and alcohol
      (3) Blanket or sheet
   b. Skill
      (1) One-person CPR
      (2) Two-person CPR
      (3) Precordial thump
2. Group 3:
   a. Equipment
      (1) Infant manikin
      (2) Alcohol swabs and alcohol
      (3) Blanket or sheet
   b. Skill—infant CPR

Have the students switch groups when all members of a given group have had an opportunity to practice their assigned skills.

Practice Session 2

Equipment

EKG monitor
Alcohol swabs and alcohol
Electrodes (different types)
Adult manikin

Procedure

Set up two skill stations:

1. Station 1—practice monitoring each other
2. Station 2—practice carotid massage*

Have students circulate to each station and practice the skills. The instructor should circulate around the two skill practice stations and correct any errors that are observed.

Practice Session 3

Equipment

Arrhythmia Annie
Defibrillator
Electrode jelly
Adult manikin (at least two)
Alcohol swabs
Cardiac press
*Automatic, gas-powered compressor
*Oxygen (compressed air)

Procedure

Set up two practice stations or areas, one for defibrillation and cardioversion and one mechanical CPR device. Have the students alternate in practicing the required skills—assign one-half of the students to each of the practice stations and have them move to the next station when they feel they have had sufficient practice opportunity. The instructor should circulate among the students and correct any errors that are seen.

In using Arrhythmia Annie, students can practice identifying arrhythmias before and after defibrillation.

*Indicates optional skill.

NOTES

Student's name _____

Date _____

NOTES

	One rescuer	Two rescuers
Pass	_____	_____
Fail	_____	_____

Skill Evaluation 6.1.S: Unwitnessed Cardiac Arrest—One and Two Rescuers

Place an "X" in the appropriate column to indicate the steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform the skill.

___ ___ ___ A. Establish unresponsiveness of the victim by shaking him and shouting, "Are you OK?", allowing adequate time for response (5–10 seconds).

___ ___ ___ B. Position the victim's head and neck to establish an open airway.

___ ___ ___ C. Check breathing using look, listen, and feel. Allow a minimum of 5 seconds to evaluate breathing.

___ ___ ___ D. If breathing is absent, make an airtight seal over the patient's mouth, pinch the nostrils, and blow into patient's mouth until the chest rises.

___ ___ ___ E. Ventilate the patient four times with deep breaths, with the student glancing to check the rise and fall of the chest for each breath.

___ ___ ___ F. Check the carotid pulse, being sure not to reach across the patient to do so. Allow a minimum of 10 seconds to evaluate the pulse. Check the pupils for size and reactivity.

NOTES

___ ___ ___ G. If a pulse is absent, determine the location for hands to be placed on the sternum (middle of the lower half of the sternum).

___ ___ ___ H. Place hands on the sternum, being sure that fingers are not resting on the ribs, and that pressure will only be applied directly on the sternum with the heel of the hand.

___ ___ ___ I. Compress the chest 1½ to 2 inches 15 times to insure that the pressure is in a rhythmic motion and not a sharp jerk compression. (Rate is at 80 per minute.) Rescuer says mnemonic.

___ ___ ___ J. Continue procedure by alternating two quick ventilations with each 15 compressions.

___ ___ ___ K. After four cycles, check the carotid pulse, pupil reaction and breathing. (The second rescuer will enter and assist the first.)

___ ___ ___ L. Change the rate of compression to 60 per minute. Rescuer says mnemonic.

___ ___ ___ M. Interpose a ventilation every fifth compression but do not pause for the ventilations. Rescuer doing the ventilations checks the pulse and pupil status.

___ ___ ___ N. Rescuer doing compressions should request to shift places with the first rescuer.

___ ___ ___ O. Rescuers should then switch, being sure not to skip any compressions. (Two-man CPR is continued and switching occurs to the satisfaction of the instructor.)

Student's name _____

Date _____

Pass

Fail

Skill Evaluation 6.2.S: Witnessed Cardiac Arrest—One Rescuer

Place an "X" in the appropriate column to indicate the steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform each skill.

___ ___ ___ A. Position the victim's head and neck to establish an open airway.

___ ___ ___ B. Check for carotid pulse, being sure not to reach across the patient to do so. Allow a minimum of 10 seconds to evaluate pulse.

___ ___ ___ C. If a pulse is absent, give a precordial thump by raising the fist 8 to 12 inches above the sternum and giving a sharp blow.

___ ___ ___ D. Make an airtight seal over the patient's mouth, pinch the nostrils, and blow into the patient's mouth until the chest rises.

___ ___ ___ E. Give four ventilations with deep breaths, with the student glancing to check for the rise and fall of the chest at each breath.

___ ___ ___ F. Check for a carotid pulse, being sure not to reach across the patient to do so. Allow a minimum of 10 seconds to evaluate the pulse.

___ ___ ___ G. If no pulse is present, initiate cardiac compressions and continue one-man CPR as defined in the unwitnessed cardiac arrest.

NOTES

Student's name_____

Date _____

Pass

Fail

Skill Evaluation 6.3.S: Infant Resuscitation

Place an "X" in the appropriate column to indicate the steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform each skill.

___ ___ ___ A. Establish unresponsiveness of the infant by shaking him or tickling his feet, allowing 3 to 5 seconds for response.

___ ___ ___ B. Position the infant's head and neck to establish an airway, remembering not to hyperextend the neck as much as for an adult.

___ ___ ___ C. Look, listen, and feel for breathing. Allow a minimum of 3 seconds to evaluate breathing.

___ ___ ___ D. If breathing is absent, make an airtight seal over the infant's mouth and nose and blow small puffs of air into the infant's mouth.

___ ___ ___ E. Ventilate the infant with four quick puffs, with the student glancing to check the rise and fall of the chest for each breath.

___ ___ ___ F. Check for carotid pulse or apical pulse. Allow a minimum of 10 seconds to evaluate the pulse.

___ ___ ___ G. If a pulse is absent, determine the location for fingers to be placed on the sternum (middle of the sternum).

NOTES

___ ___ ___ H. Using the tips of two fingers, compress the chest ½ to ¾ inches at a rate of 80–100 times per minute.

___ ___ ___ I. Ventilation should be interposed after every five compressions with no pause.

NOTES

Student's name_____

Date _____

Pass 1 2 3

Fail 1 2 3

Skill Evaluation 6.3.1.S: EKG Monitoring

Place an "X" in the appropriate column to indicate the steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform each skill.

Equipment

EKG monitor
Electrode jelly

Procedure

Have the student being evaluated obtain an EKG record and another student as a subject.

Inform the student that he will only have three opportunities to be successful.

Inform the student that he may have a few minutes to practice the skill before he is evaluated, but you are not to help him during this time.

Steps

___ ___ ___ A. Check equipment for broken cable tips, broken cable wires, and broken connectors.

___ ___ ___ B. Select the location for the electrodes.

___ ___ ___ C. Remove the patient's shirt and clean the area with alcohol, alcohol swabs, and plastic abrasive pads.

NOTES

___ ___ ___ D. Apply the electrolytic compound (unless using needle electrodes or disposable disks).

___ ___ ___ E. Securely attach all electrodes in the proper locations.

___ ___ ___ F. Obtain a reading.

NOTES

Student's name_____

Date _____

Pass 1 2 3

Fail 1 2 3

Skill Evaluation 6.4.2.S:* Carotid Massage

Place an "X" in the appropriate column to indicate the steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform each skill.

Equipment

Adult manikin

Procedure

Inform the student that he is to assume the patient is having a rapid supraventricular tachycardia and that he is to perform a carotid massage.

Inform the student that he will have three opportunities to be successful.

Inform the student that he may have a few minutes to practice the skill before evaluation begins, but that you are not permitted to help him.

Tell the student to assume that the patient is being monitored.

Inform the student when you are ready to begin.

Steps

___ ___ ___ A. Position the patient on his back.

___ ___ ___ B. Attach the EKG monitor.

___ ___ ___ C. Hyperextend the neck.

*Indicates optional skill.

NOTES

NOTES

___ ___ ___ D. Tilt the patient's head to either side.

___ ___ ___ E. Gently palpate the carotid pulse separately on each side.

___ ___ ___ F. Place the index and middle fingers over the carotid artery, below the angle of the jaw, and as high up on the neck as possible.

___ ___ ___ G. Massage the artery by forcefully pressing against the vertebral column and rapidly rubbing up and down (no longer than 15 to 20 seconds).

___ ___ ___ H. Check the EKG monitor.

(Instructor should inform the student that the patient is still experiencing supraventricular tachycardia.)

___ ___ ___ I. Repeat the procedures after 2 or 3 minutes, on the other side.

NOTES

Student's name _____

Date _____

Pass 1 2 3

Fail 1 2 3

Skill Evaluation 6.5.3.S: Defibrillation

Place an "X" in the appropriate column to indicate the steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform each skill.

Equipment

Defibrillator
Electrode jelly or saline gauze pads
Adult manikin
Arrhythmia Annie

Procedure

Inform the students they are to be evaluated on their ability to perform defibrillation and cardioversion.

Inform the students that this skill requires two performers. Assign one student as Technician 1 and the other as Technician 2. After an evaluation is completed, have the students switch roles.

Inform the students that they have three opportunities to be successful.

Inform the students that they may have a few minutes to look over the equipment and practice as a team. Inform them, however, that you may not help them or give them advice.

Begin when ready; start with defibrillation.

Steps—Technician 2

___ ___ ___ A. Do a primary survey.

___ ___ ___ B. Start basic life support.

___ ___ ___ C. Continue basic life support.

Steps—Technician 1

___ ___ ___ D. Ready the defibrillator.

___ ___ ___ E. Bare the chest.

___ ___ ___ F. Turn on the equipment to charge it.

___ ___ ___ G. Apply saline gauze pads or electrode jelly to the paddles.

___ ___ ___ H. Inform Technician 2, "Equipment ready."

___ ___ ___ I. Upon request, hand Technician 2 the paddles.

Steps—Technician 2

___ ___ ___ J. Receive the positive paddle in the left hand while kneeling at the patient's side.

___ ___ ___ K. Receive the negative paddle in the right hand.

___ ___ ___ L. Place the positive paddle to the left of the patient's left nipple.

___ ___ ___ M. Place the negative paddle on patient's upper chest, in an angle formed by the right clavicle and sternum.

___ ___ ___ N. Press the paddle firmly against patient's chest wall and verify arrhythmia on the scope.

(Instructor should inform Technician 2 that the arrhythmia is ventricular tachycardia.)

___ ___ ___ O. Say to Technician 1, "Stand back! Defibrillate on three ... one, two, three." On three, depress both buttons.

NOTES

___ ___ ___ P. Observe the scope.

(Instructor should inform Technician 2 that arrhythmia is ventricular fibrillation.)

___ ___ ___ Q. Return the paddles to Technician 1.

___ ___ ___ R. Continue basic life support.

___ ___ ___ S. Receive the paddles.

___ ___ ___ T. Verify arrhythmia.

(Instructor should inform student that arrhythmia is still ventricular fibrillation.)

___ ___ ___ U. Say to Technician 2, "Stand back! Defibrillation on three ... one, two, three." On three, depress both buttons.

___ ___ ___ V. Verify arrhythmia.

(Instructor should inform technicians to stop.)

*Steps—Cardioversion**

(Instructor should inform students that arrhythmia is rapid ventricular tachycardia and that they are to deliver a synchronized shock.)

___ ___ ___ A. Turn synchronized button to the "on" position.

___ ___ ___ B. Turn on the main power

(Instructor should inform the students to use 20 watt-seconds.)

___ ___ ___ C. Set the energy button to 20 watt-seconds.)

___ ___ ___ D. Prepare and apply the paddles.

*Indicates optional skill.

NOTES

___ ___ ___ E. Give the command, "Stand back!"

___ ___ ___ F. Depress the firing button and wait for the synchronizer to fire.

NOTES

Student's name _____

Date _____

Pass 1 2 3

Fail 1 2 3

Skill Evaluation 6.5.4.S:* Intracardiac Injections

Place an "X" in the appropriate column to indicate steps that are incorrect, out of sequence, or omitted. The student should be given three attempts to perform each skill.

Equipment

Syringe
Long (spinal) needle
Cadaver
Alcohol wipes

Procedure

Inform the student that he is to be evaluated on his ability to perform an intracardiac injection.

Inform the student that this evaluation will take place right after the demonstration session and he will have an opportunity to practice.

Inform the student that he will have three opportunities to be successful.

Steps

___ ___ ___ A. Connect a long (spinal) needle to a syringe.

___ ___ ___ B. Locate the fourth or fifth intercostal space.

___ ___ ___ C. Insert the needle at a right angle to the chest wall; maintain a slight pull on the plunger.

*Indicates optional skill.

NOTES

___ ___ ___ D. After aspiration of blood, which indicates correct intracardiac position, inject the contents.

___ ___ ___ E. Rapidly withdraw the needle.

NOTES

Student's name _____

Date _____

Pass 1 2 3

Fail 1 2 3

Skill Evaluation 6.5.5.S:* Mechanical CPR Devices

Place an "X" in the appropriate column to indicate steps that are incorrect, out of sequence, or omitted. The student should be allowed three attempts to perform each skill.

Equipment

Cardiac press
Automatic, gas-powered compressor
Adult manikin
Alcohol swabs

Procedure

Inform the students that this skill evaluation requires two persons. Assign one student as Technician 1 and another as Technician 2. After one evaluation is completed, have the students switch roles.

Inform the students that they are going to be evaluated one at a time on their ability to use the cardiac press and the automatic, gas-powered compressor, that they will have three opportunities to be successful, and that they must pass both skills.

Inform the students that they may have a few minutes to examine the equipment and practice the skill, but that you cannot help them.

When ready, ask the students to begin with the cardiac press.

Steps—Cardiac Press

___ ___ ___ A. Technician 1 initiates CPR using manual methods and continues until the equipment has been set up.

*Indicates optional skill.

NOTES

___ ___ ___ B. Technician 2 readies the equipment.

___ ___ ___ C. Technician 2 slides the backboard of the press under the patient's back and places the frames into position knobs.

___ ___ ___ D. Technician 2 adjusts the adjustment knob and positions the plunger (centrally on the lower half of the sternum), making sure the adjustment knob is retightened.

___ ___ ___ E. Technician 2 presses the handle down with a brisk movement, then releases the handle. (Compressions are delivered approximately every second.)

___ ___ ___ F. Technician 1 interposes a ventilation after every fifth compression.

Steps—Automatic, Gas-Powered Compressor

___ ___ ___ A. Technician 1 initiates CPR by manual methods.

___ ___ ___ B. Technician 2 secures the equipment and makes it ready.

___ ___ ___ C. Technician 1 rolls the patient on his side (5 seconds).

___ ___ ___ D. Technician 2 positions the base plate under the patient so the lower part of the patient's sternum is over the center of the plate.

___ ___ ___ E. Technician 1 rolls the patient back in a supine position.

___ ___ ___ F. Technician 1 resumes CPR.

___ ___ ___ G. Technician 2 mounts, positions, and places in operation the automatic chest compressor.

NOTES

___ ___ ___ H. Technician 1 interposes ventilation after every fifth compression.

___ ___ ___ I. Technician 2 sets up the ventilation equipment.

___ ___ ___ J. Technician 1 switches to ventilation equipment and checks to be sure the chest rises.

___ ___ ___ K. Technician 2 checks for the carotid pulse with compressions.

NOTES

UNIT 7 emt-p

CLINICAL EXPERIENCE

NOTES

Description of Unit

In the previous units, the students were trained to perform skills in simulated situations in the classroom. The purpose of the clinical experience is to provide the student with the opportunity to become proficient in these skills.

If a number of modules are being presented together, it is not necessary for the clinical experience to be presented after each module. The clinical experience associated with each module can be combined and presented upon completion of the classroom sessions.

Objectives

The following objectives are proposed for the clinical experience. Because of patient availability, it is possible that all skills listed below may not be performed by the student; but as many skills as possible should be observed and practiced by the student under the supervision of the preceptor.

Emergency Department

During the experience in the emergency department, the student will have the opportunity to practice on actual patients under direct supervision and to demonstrate with proficiency, to the satisfaction of the preceptor, each of the following:

- Assist and review the treatment of trauma cases and medical emergencies. At a minimum, the student should review cases of:

NOTES

- Angina pectoris
- Acute myocardial infarction
- Congestive heart failure
- Ventricular aneurysm
- Cardiogenic shock
- Myocardial trauma
- Acute hypertensive crisis

- Prepare and administer intramuscular, subcutaneous, and intravenous medications as directed by the preceptor.
- Observe the effects of pharmacological agents administered.
- Assist in cases of cardiac arrest as directed by the preceptor, including the performance of cardiopulmonary resuscitation, management of the airway, endotracheal intubation, and defibrillation.
- Apply monitoring electrodes, monitor cardioscope, and interpret EKG (lead II), noting any irregularities.
- Perform phlebotomy in cases of acute heart failure.*
- Demonstrate the use of transthoracic pacemaker.*

Intensive Care Unit/Coronary Care Unit

During the experience in the intensive care unit/coronary care unit, the student will have the opportunity to practice on actual patients under direct supervision and to demonstrate to the satisfaction of the preceptor, each of the following:

- Assist and review the treatment of trauma cases and medical emergencies. At a minimum, the student should review cases of:

  - Angina pectoris
  - Acute myocardial infarction
  - Congestive heart failure
  - Ventricular aneurysm
  - Cardiogenic shock
  - Myocardial trauma
  - Acute hypertensive crisis

*Indicates optional skill.

- Prepare and administer intramuscular, subcutaneous, and intravenous medications as directed by the preceptor.
- Observe the effects of pharmacological agents administered.
- Assist in cases of cardiac arrest as directed by the preceptor, including the performance of cardiopulmonary resuscitation, management of the airway, endotracheal intubation, and defibrillation.
- Apply monitoring electrodes, monitor cardioscope, and interpret EKG (lead II), noting any irregularities.
- Demonstrate the use of transthoracic pacemaker.*

NOTES

Upon completion of the clinical experience, the trainee should be involved in a supervised internship on the vehicle. During this internship, the trainee will be supervised by a preceptor (physician, nurse, or certified EMT) in the skills presented during the training program. Guidelines for this internship are identical to those presented for the other clinical areas and should be used as a reference.

Preceptor Activities

Review the objectives with the course coordinator and discuss which objectives are to be included in the unit activities. If the preceptor has any questions concerning specific skills or procedures, he should be referred to the appropriate module for a review of the materials presented to the student.

Have the student sign in and determine his proper attire—for example, sterile greens.

Review the rules and operating procedures within the unit, making certain to define the student's role within the unit. Any special regulations concerning the student's activities should be defined.

Define those skills that will and will not be included in this instructional unit, but were discussed during the classroom activities.

Review the history, diagnosis, complications, and treatment of each patient in the unit. The activities of the student should not be limited to those specifically defined in the objectives.

For each activity, demonstrate the skill initially; then coach the student through the skill at least one time and observe the student as he performs the skill.

*Indicates optional skill.

Supervise the student when he is performing activities within the unit. The preceptor should critically review the student's technique and suggest corrections when appropriate.

Assist and evaluate the student until he is competent in each activity on the checklist.

Answer any of the student's questions concerning activities in the unit or specific patients and their conditions.

Review the objectives for this instructional unit periodically, and discuss the student's progress with respect to the items on the checklist.

Mark the student's activities checklist after each clinical session. The checklist should be marked indicating the number of total observations (O), total attempts to perform the activity by the student (T), and the number of successful attempts (S) for each activity. Once the student has successfully demonstrated the skill, the session number during which the preceptor made the evaluation should be entered in the "Completed" column. Any comments should be listed in the appropriate space. Specifically, comment should be made if the student does not become proficient at any given skill. Once the student has successfully demonstrated his proficiency at a given skill, however, he should still continue to perform the skill while in the unit.

Student Activities

The student should:

- Report to the specialty unit on his scheduled date and shift and "sign in" with the supervisor
- Review the rules and operating procedures within the unit with the preceptor, making certain that his role in the unit is defined
- Review the history, diagnosis, complications, and treatment of each patient in the unit
- Observe and participate in unit activities as directed by the preceptor (If the student observes a technique or procedure performed differently from its presentation during the classroom activities, he may question the preceptor about differences observed, but remember that the techniques presented during the lecture may not be the only correct method.)
- Perform each activity on the checklist (when appropriate) under

NOTES

the direct supervision of the preceptor (If the student is unsure of the activity, the preceptor will demonstrate the skill.)

- Review each activity performed with the preceptor, and be sure the preceptor critiques his performance
- Be sure the preceptor marks the checklist after each clinical session
- Develop a log on each patient seen during the experience—the log should include the following information as a minimum:

  — Patient's record identification—use identification number rather than patient's name
  — Major problem—that is, trauma, acute appendicitis
  — Complications
  — Skills and activities observed
  — Skills performed—that is, initiated IV, monitored cardiac activity

The preceptor and the student should review the objectives in the instructional unit and discuss which activities will be included in the experience.

NOTES

Emergency Department

Student's name _____

Completed	Activities (objectives)	Session number 1			2			3			4			5			Comments
		O	T	S	O	T	S	O	T	S	O	T	S	O	T	S	
	Assist and review the treatment of cases of: Angina pectoris Acute myocardial infarction Congestive heart failure Ventricular aneurysm Cardiogenic shock Myocardial trauma Acute hypertensive crisis																
	Preceptor																
	Date																

Note.—O = observations; T = student attempts; S = successful attempts.

Intensive Care Unit/Coronary Care Unit

Student's name _____

Completed	Activities (objectives)	Session number														Comments
		1			2			3			4			5		
		O	T	S	O	T	S	O	T	S	O	T	S	O	T	S	
	Assist and review the treatment of cases of: Angina pectoris Acute myocardial infarction Congestive heart failure Ventricular aneurysm Cardiogenic shock Myocardial trauma Acute hypertensive crisis															
	Preceptor															
	Date															

Note.—O = observations; T = student attempts; S = successful attempts.

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